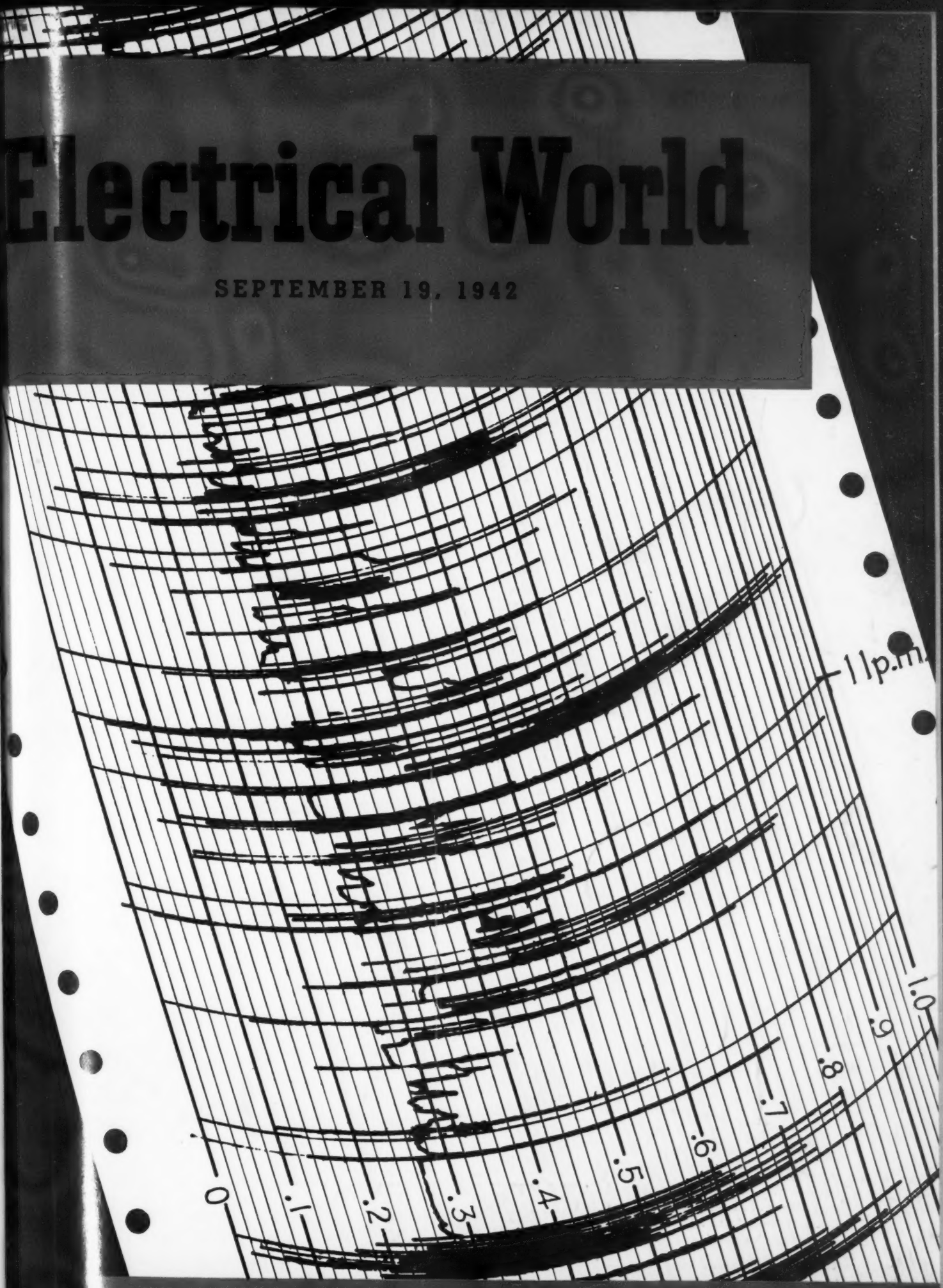
Electrical World

SEPTEMBER 19, 1942



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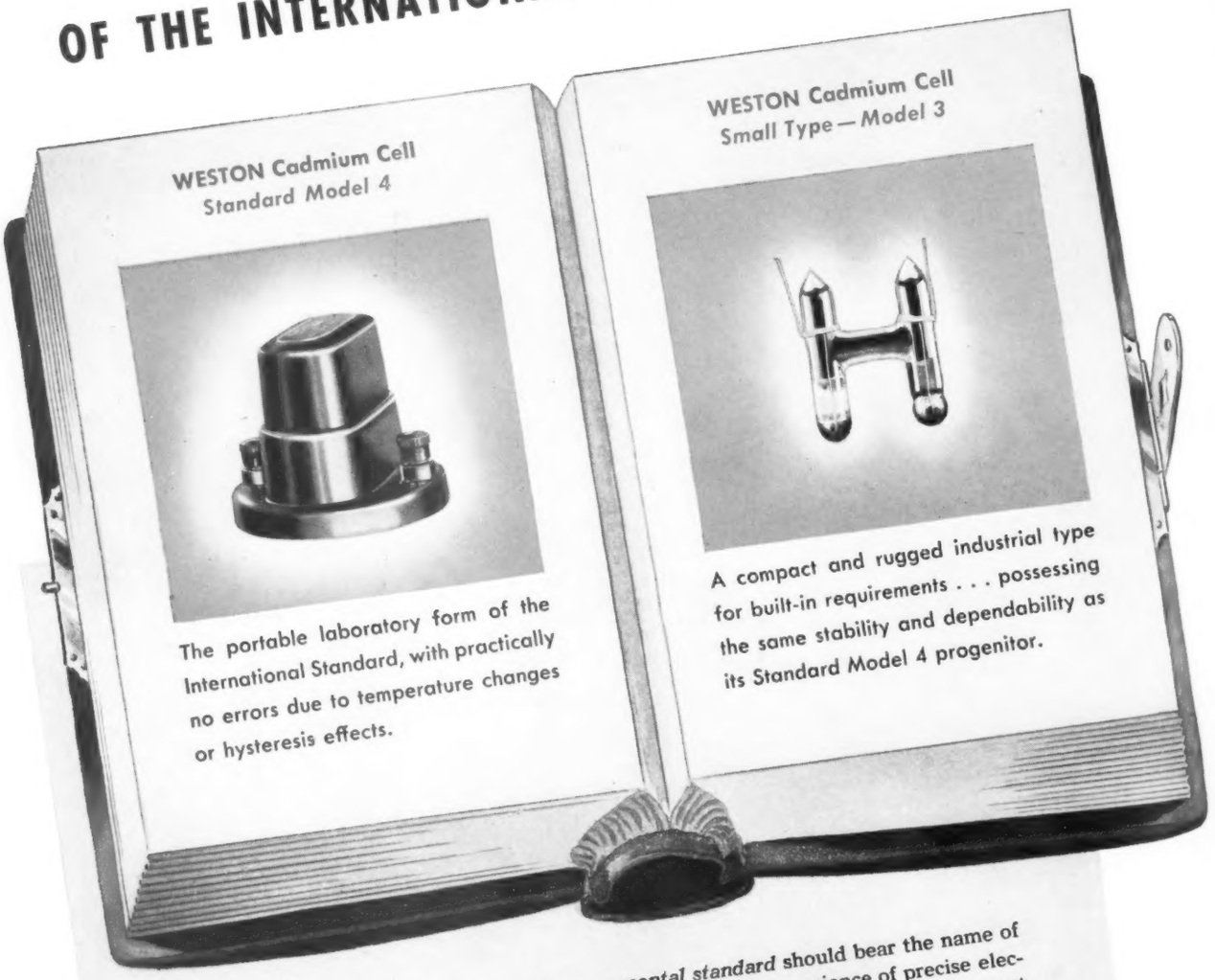
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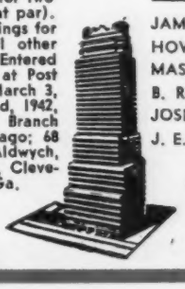

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Dead Circuits

One of our subscribers has suggested that we start a national campaign to recover copper from "dead circuits" and obsolete equipment.

"In the past few days," says this power engineer, "I've seen, after asking questions, many panelboards with large copper open type knife switches and many feet of large and small wire which have been left in place after new production layouts have been accomplished. Every old plant and old retail establishment has reclaimable 'dead circuits.' "

Isn't this a real idea for the entire electrical industry? Doesn't it offer many possibilities for local cooperative effort?

Right now copper is about the most critical metal in the war program. Every pound of it is needed so badly. If there are dead circuits and obsolete equipment that can be removed we should seek them out and make the material available.

These circuits and old equipment were left in place because at the time it would cost more to remove them than they were worth as junk. The same probably is true today, but we no longer can permit ourselves to be guided alone by dollar value. There are other values that are much more important.

Who is going to pay for this "dead circuit" removal? We suggest that this offers the contractor, the wireman, the inspector, the utility and the customer an opportunity to work together, each doing his bit without any other compensation than the knowledge that he is helping win the war.

The utility through its power and commercial sales organization can locate the jobs where the lighting has been done over, or the whole layout remodeled or a stationary plant removed, or a change made from d.c. to a.c., and find out where old copper or equipment was left in place. These men can determine how difficult it will be to remove the scrap and, in those instances where it can be done reasonably easily secure permission from the customer.

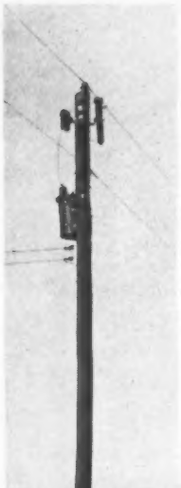
The contractor and the inspector also have information on past jobs that would help locate such scrap and the utility man should work with them.

When the permission has been secured from the customer, the wireman might give his time for the removal and the inspector see that the work is done properly. When the scrap is sold the customer might donate the proceeds to U.S.O., Red Cross or some similarly worthy cause.

This isn't a job just for one part of the industry. It is a job for all. The time is so short and the need so great that everybody must chip in. In the plan here suggested people are not asked to give dollars—they are asked to give time.

After the war there will be many opportunities for labor and contractors and inspectors and utilities to work together for mutual benefits. Today we are suggesting that they work together for the greatest mutual benefit they will ever have—national security and victory. Not only will they be helping their country and themselves, but perhaps they will learn to have in this unselfish effort a great confidence in and respect for each other that will smooth out the road of post-war cooperation.

But right now—we must get in the scrap!



Galvanized Steel as a Power Conductor

Processing results in conductor with low 60-cycle resistance and internal reactance, low permeability, coupled with high strength, high fatigue endurance, small creep

FREDERICK M. CRAPO, President Indiana Steel & Wire Co., Muncie, Ind.

Fig. 1. The data for these curves were developed in a testing machine equipped with an extensometer which could be read to millionths of an inch. These stress-strain diagrams, determined from conductor samples having tensile strengths near the low side of the range or not much in excess of the minimum guaranteed strength, have been used in conjunction with catenary curves to determine initial and final sags and tensions by the graphical methods. The assumed loadings were those specified in rule 251 of the fifth edition of the National Electrical Safety Code.

AN IMPROVED type of galvanized steel conductor developed about six years ago for certain peacetime uses in rural distribution systems is now attracting the special interest of engineers because of its possibilities during the war emergency as a substitute for conductor materials at present difficult or impossible to obtain. This conductor, which combines in optimum degree the best electrical and physical properties of all the older types of iron and steel, is one of the research products of Indiana Steel & Wire Company and is identified as type HTC-130 steel. It has been placed in service by electric utilities in many parts of the country, having thus established an economic field of its own under peacetime conditions.

Meanwhile, it has materially advanced the technological basis for the application of steel conductors in power distribution and transmission, dispelling much of the former confusion and misunderstanding in relation to the properties of iron and steel conductors generally, but especially when carrying 60-cycle power currents. Technical problems attendant on both the normal and the emergency uses of these HTC-130 steel conductors of course require detailed knowledge of their properties, which are here rather briefly described.

These new ferrous conductors are manufactured from medium-carbon steel of special analysis and also are subjected to certain special process treatments during their fabrication. Their distinctive properties are relatively low 60-cycle resistance, low magnetic permeability and low 60-cycle internal reactance, in combination with relatively high tensile strength, high fatigue endurance, small creep under initial sustained loads, sufficient ductility to insure appreciable elongation before rupture, and high resistance to shock and deformation. They receive certain special heat treatments at appropriate stages in the process of cold-drawing to final size, which produce advantageous end effects on both the electrical properties and the physical properties of the finished conductors. Young's modulus after initial loading to maximum design tension, or equivalent pre-stressing, is a relatively high and constant figure for stranded as well as solid conductors. The physical properties of HTC-130 steel conductors are shown in Table I.

A typical stress-strain curve for HTC-130 steel conductor is shown in

Skin Effect and Reactance

Relatively low skin effect and low reactance of these conductors result from the control of magnetic permeability by means of the special steel used and also by means of the process treatments during the course of manufacture. Low permeability is advantageous with alternating-current conductors for well-known reasons; it promotes low skin effect and low internal reactance. Stranded steel conductors have lower skin effect, lower effective resistance and lower internal reactance than solid conductors of the same material and cross-section. These decreases are attributable to the subdivision of the current among the individual wires comprising the conductor, and also to the fact that the internal magnetic effect of each strand of current is confined in large degree to its own individual wire.

Effective resistances and reactances shown in Table II for 60-cycle currents up to 10 amp. were determined

from tests made on parallel loops of conductor about 150 ft. in length, with the two sides spaced about 18 in. on centers. The reactances at other spacings were computed from these test results. All resistances shown in the table are ultimate values after the temperatures of the conductors have become constant, when suspended in a still atmosphere at an ambient temperature of 68 deg. F. Consequently the tabular resistances include the heating effect caused by energy losses in the conductors, without the benefits of the cooling caused by air movements which nearly always are present under outdoor conditions.

Configuration Factor

Reactances in Table II are expressed in ohms per mile of conductor at 60 cycles and apply directly to two-wire circuits and also to three-phase, three-wire circuits with symmetrical triangular spacings. For other three-wire configurations the equivalent spacing can be computed by the familiar rule, based on the cube root of the product of the three actual spacings.

Hitherto there has been considerable misunderstanding and confusion among users of iron and steel conductors concerning their respective properties and advantages, and also what constitute their economic applications. It may be pointed out that none of these materials which are characterized by relatively high magnetic permeability, as, for example, iron and mild steel, are suitable or efficient as power conductors with 60-cycle alternating currents. It is self-evident that the new steel conductors are much superior (Fig. 2) in 60-cycle resistance to commercial grades of iron and, of course, mild steel, which, however, have important advantages for other types of applications.

One of the useful yardsticks for determining the suitability of any specific conductor for a given distribution or transmission job is its load-carrying capacity in kilowatt-miles, under a stated system of operation, line voltage, power factor of load and voltage drop. This yardstick equals the product of the length of the line in miles and the concentrated load at the far end in kilowatts. It is approximately a constant quantity for any given conductor, with a stated line voltage, percent of voltage drop, power factor of load and specified

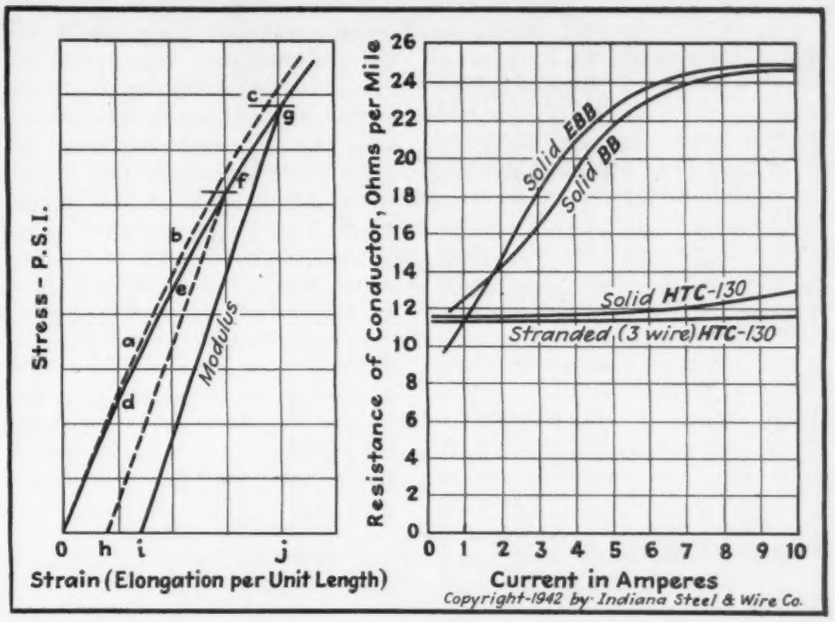

Stress - P.S.I.
Strain (Elongation per Unit Length)
Modulus
0 h i j
a b c d e f g
Resistance of Conductor, Ohms per Mile
Current in Amperes
Solid EBB
Solid BB
Solid HTC-130
Stranded (3 wire) HTC-130
0 1 2 3 4 5 6 7 8 9 10
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Copyright-1942 by Indiana Steel & Wire Co.

FIG. 1—Stress-strain curve for HTC-130 steel conductor.

Curve o *a b* c (Fig. 1) represents the initial loading up to maximum design tension applied at about the same rate it would build up in an outdoor span in a glaze storm. The curve o *d e g* represents the results of initial loading after holding the load constant at any intensity until stretching ceases. The lines *f h* and *g i* represent the modulus line determined by unloading and reloading the test specimen. The elongation o *i* represents the total set, including creep, after loading to maximum design tension c *g* and holding this load constant until stretching ceases.

FIG. 2—The 60-cycle resistances of HTC-130 steel conductors of Size No. 6 BWG in both solid and stranded (three-wire) construction compared with the same sizes of solid iron wires of E.B.B. and B.B. grades, with currents up to 10 amp.

system of operation. At equal voltages the kilowatt-miles of a three-phase line (with balanced loads) are twice those of a single-phase line, and when other conditions are unchanged, except the line voltage, the kilowatt-miles are directly proportional to the square of the voltage. Therefore the kilowatt-miles of a three-phase, four-wire line with balanced load are six times as large as the kilowatt-miles of a single-phase branch comprised of one phase-wire and neutral.

The kilowatt-miles of No. 4 and No. 6 BWG stranded (three-wire) circuits operated at 12,000 volts, three-phase, and 6,900 volts, single-phase, with voltage drops from 1 percent to 5 percent and with power factors of the load of 1.00, 0.90 and 0.80, are shown in Table III. The loads are assumed to be concentrated at the far end of the line. These results are approximately correct for currents up to 10 amp. and conductor spacings from 36 in. up to 60 in. When the loads are uniformly distributed, a given line will serve twice as much total load as when concentrated at the far end, with equal over-all voltage drops.

Long-span construction brings out the full economic advantages of these steel conductors, especially in pri-

Table I—Physical Properties of Stranded (3-Wire) and Solid HTC-130 Steel Conductors

(Copyright 1938 by Indiana Steel & Wire Co.)

Conductor Size BWG	Number of Wires	Diameter of Conductor (in.)	Cross-Section: Circular Mils	Approximate Weight		Minimum Breaking Strength (lb.)
				Lb. per 1,000 ft.	Lb. per Mile	
4	3/0.138	0.297	57,132	156	823	5,610
6	3/0.117	0.252	41,067	112	590	4,295
4	1/0.238	0.238	56,644	154	811	5,784
6	1/0.203	0.203	41,209	112	590	4,208

mary circuits of rural distribution lines. The maximum level-ground spans with No. 6 stranded (three-wire) conductor on 35-ft. poles, with vertical construction, are 563 ft., 694 ft. and 762 ft. in heavy, medium and light loading districts, respectively. Span lengths of this order, designed to sustain maximum loads at tensile stresses of 60 percent of ultimate strength of the conductor, require care in design and construction properly to reduce local stress concentrations and prevent vibration failures.

A half-mile experimental line of these conductors was built on 35-ft. wood poles in an exposed location in Indiana and maintained under test and observation for about two years. Span lengths of 400 to 800 ft. in length were used, with conductor tensions ranging from about 30 percent above normal to 30 percent below. Continuous simultaneous records were made of wind velocity, wind direction, vibration frequency of the conductor, total vibration travel (double amplitude) and conductor tension. The greatest movement (double amplitude) was less than 0.07 in. and occurred at 45 cycles for a limited period only. Movements of as much as 0.04 in. occurred infrequently and usually were less than half as much, while the frequencies were ordinarily at least 100 cycles and from that up to 200 cycles, or sometimes even higher. The characteristic loop length of No. 6 BWG conductor of HTC steel, vibrating at about 50 cycles per second, is on the order of 6 ft. and becomes shorter as the frequency increases.

Conductor stresses caused by vibration having the foregoing characteristics are not, in and of themselves, of serious character with HTC steel conductors. However, when superimposed on excessive normal tensions, or severe local stress concentrations, they may ultimately result in fatigue failures. Such results must be avoided by proper design and installation. Vibration which occurs under field conditions can be simulated on short indoor spans by means of forced vibrations, with greatly magnified amplitudes and sufficient increase in repeated stresses to cause fatigue failures in comparatively short periods. This has provided a valuable method for testing various types of conductor fittings and fastenings.

Table II—Resistance and Reactance of HTC-130 Steel Conductors

(Copyright 1938 by Indiana Steel & Wire Co.)

Conductor Size BWG	Current (Amp.)	Resistance: Ohms per Mile	Reactances*: Ohms per Mile at Spacings Shown Below				
			24 in.	36 in.	48 in.	60 in.	72 in.
Stranded (3-Wire) Conductors							
4	1.0	8.07	1.35	1.40	1.43	1.46	1.48
	2.5	8.20	1.36	1.41	1.44	1.47	1.49
	5.0	8.39	1.40	1.45	1.48	1.51	1.53
	7.5	8.60	1.43	1.48	1.51	1.54	1.56
	10.0	8.83	1.48	1.53	1.56	1.59	1.61
6	1.0	11.29	1.37	1.42	1.45	1.48	1.50
	2.5	11.31	1.38	1.43	1.46	1.49	1.51
	5.0	11.36	1.42	1.47	1.50	1.53	1.55
	7.5	11.43	1.45	1.50	1.53	1.56	1.58
	10.0	11.53	1.50	1.55	1.58	1.61	1.63
Solid Conductors							
4	1.0	8.25	2.12	2.17	2.20	2.23	2.25
	2.5	8.44	2.30	2.35	2.38	2.41	2.43
	5.0	8.77	2.66	2.70	2.74	2.77	2.79
	7.5	9.18	3.13	3.18	3.22	3.24	3.27
	10.0	9.83	3.65	3.70	3.73	3.76	3.78
6	1.0	11.37	2.14	2.19	2.22	2.25	2.27
	2.5	11.48	2.32	2.37	2.40	2.43	2.45
	5.0	11.76	2.67	2.72	2.76	2.79	2.81
	7.5	12.26	3.15	3.20	3.24	3.26	3.29
	10.0	12.87	3.69	3.74	3.77	3.80	3.82

* Per mile of each conductor of a single-phase, two-phase or three-phase circuit, with the conductor spacings (center-to-center) shown above.

Table III—Kilowatt-Miles of 12,000-Volt Three-Phase and 6,900-Volt Single-Phase Circuits of Stranded (3-Wire) HTC-130 Steel Conductors

(The voltages are those delivered at the end of the line)

(Copyright 1940 by Indiana Steel & Wire Co.)

Conductor Size BWG	Percent Voltage Drop	At 12,000 Volts With Three-Phase Balanced Loads and Following Power Factors			At 6,900 Volts With Single-Phase Loads and Following Power Factors		
		1.00	0.90	0.80	1.00	0.90	0.80
4	1	174	160	154	29	27	26
	2	348	321	307	58	53	51
	3	522	481	460	87	80	77
	4	697	641	613	116	107	102
	5	870	801	765	145	134	128
6	1	126	119	115	21	20	19
	2	253	237	230	42	40	38
	3	379	357	344	63	59	57
	4	505	474	458	84	79	76
	5	631	593	571	105	99	95

Ties and Splices

The type of tie which was developed especially for these HTC steel conductors in long spans, and which has been used more than any other, is a special form of armor tie. It provides structural reinforcement and protection of the conductor and acts also as a graded vibration damper and arcing shield. Another type of tie used is a special T-tie, which requires two tie wires; it also can be applied without difficulty and has excellent endurance under vibration.

Conductor splices of the straight-line type, made with compression-type sleeves or twist-type seamless sleeves, have both been used, the former most extensively. Dead-ends made with compression-type sleeves have been found superior to clamps or spool-type fastenings. Splices and dead-ends of the straight-line automatic type also have been satisfactory in many instances, especially for small jobs and making quick repairs.

HTC steel conductors are well adapted for long-span construction because of their high endurance limits, toughness and resistance to shock and their general all-round ability to withstand severe service. They require no more care in installation than any other type of conductor.

During the relatively short period of six years since these type HTC steel conductors were first made available there have been relatively few installations which realized their full economic possibilities in terms of delivered loads. On the other hand, a large percentage of the installations have capitalized the economic advantages of long-span construction, particularly in rural distribution. The principal class of application has been for rural tap lines and occasionally for extensions at the ends of lightly loaded branches. There are instances also of entire primary circuits of steel.

These applications for the most part are in rural distribution systems operating in the voltages class of 12,000 volts, three-phase, with 6,900-volt, single-phase branches. As yet there has been very limited application of voltage regulators and boosters to compensate for large voltage drops in long steel primaries, but theoretical studies of these possibilities indicate that the economic range of use of steel conductors can be increased considerably. The use of steel in these applications is confined almost entirely to primary circuits, as it is generally inadvisable to employ steel in secondary circuits and only in a very restricted way for common neutrals.

Another type of application in which HTC steel has been used to some extent is for the neutral conductor of four-wire primary circuits with aluminum or copper phase conductors. Here the steel provides more strength than required, but obviously contributes reinforcement to the line as a whole, while lowering the original cost. These applications have been principally in three-phase rural primaries serving farms and small communities.

Transmission Branches

Branch taps of transmission lines can be constructed in many instances with HTC steel conductors, as was done, for example, with No. 4 BWG for a short tap from a 66-kv. line of conventional type. In such an instance, with three-phase balanced loads, the kilowatt-miles shown in Table III should be multiplied by the square of the voltage ratio (square of 66/12 or square of 5.5), which is 30.25. Then, for example, a three-phase circuit of No. 4 BWG will have a capacity of approximately 4,650 kilowatt-miles (154 × 30.25) at 1 percent drop with a load power factor of 0.80. This would permit delivery of 1,000 kw. over a line 4.5 miles long, with a load current of about 9 amp. per conductor. Considerably more load could be carried over this circuit without material conductor heating or excessive voltage drop.

Since the arrival of severe wartime restrictions on the use of the conventional types of conductors for overhead distribution, the feasibility of using steel conductors has aroused much interest and discussion. Such consideration may be analyzed as falling principally under two heads—the first embracing all those applications in which the use of steel is well within the limits of technical and economic justification, and the other including the cases in which steel is an unavoidable substitute for conductors of greater normal load-carrying capacity, as one of the means of meeting the war emergency.

There is no doubt, of course, that the use of HTC steel conductors can be extended very materially by overloading them and by tolerating greater voltage drops than permitted under normal standards of service. These conductors will stand exceptionally high temperatures without annealing or appreciable impairment of tensile strength. Their economic range of use can be extended also by the application of voltage regulators, boosters and capacitors. Lastly, it may be emphasized again, particularly from the standpoint of emergency uses of steel as a substitute for conductors of inherently greater electrical efficiency, that in the economic sense steel is at its best as a high-voltage conductor, in both distribution and transmission.

Rectifier Performs Well on Fluctuating Load

Response of mercury-arc rectifier to load shock arising from sharply fluctuating d.c. load of coke ovens leads to replacement of engine-driven d.c. generators

LLOYD T. JONES,* Citizens Gas & Coke Utility, Indianapolis, Ind.

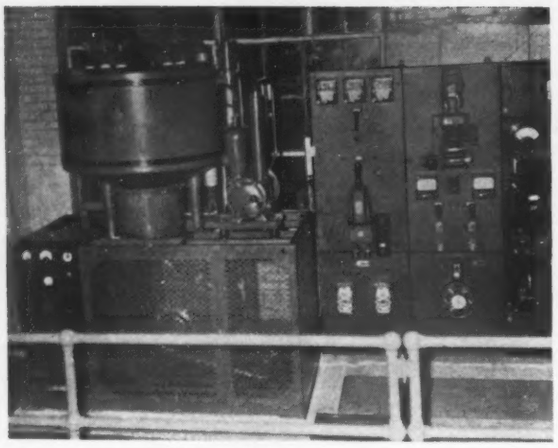
ADVANTAGE of the mercury-arc rectifier over rotating electrical equipment in instances where the shock element in widely fluctuating d.c. loads is appreciable is clearly illustrated by the case of the Citizens Gas & Coke Utility of Indianapolis, Ind., where a 150-kw. pioneer air-cooled mercury-arc rectifier installation was made during the summer of 1941.

Because of the importance of speed control in coke oven equipment all of the tractive drive equipment and a large part of the mechanical oven equipment at this plant depend upon direct current. Briefly enumerated, the d.c. equipment includes:

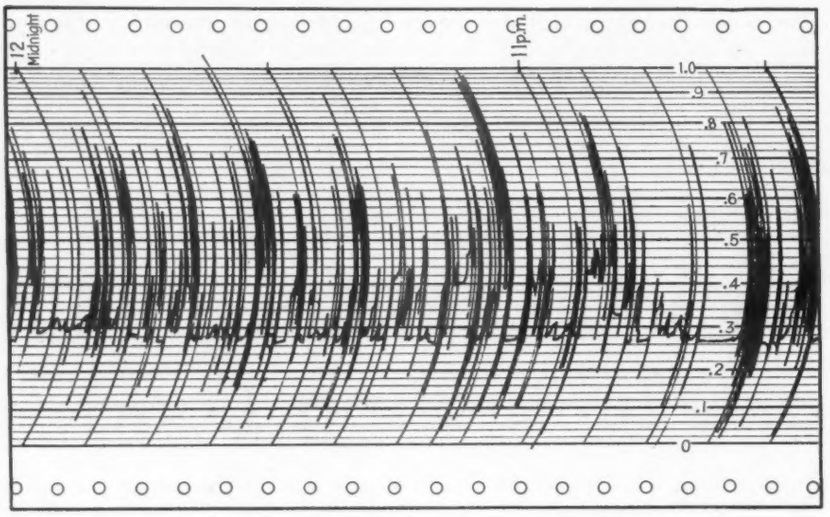
Type	Number		Total Hp.
Pushers	2	175 hp.	350
Charging cars	3	35 hp.	105
Door machines	6	25 hp.	150
Valve-reversing equipment			126
Bridge cranes	1	110 hp.	110
Stoker drives in power house			15
Quenching car locomotive	1	130	130
			986

While d.c. load demand at this plant averages around 35 kw., momentary loads as high as 210 to 250 kw. are encountered due to the shock load of the d.c. powered pushers and the bridge crane. Character of the load is shown on the typical d.c. load chart on the next page.

* Electrical engineer.



SINGLE 150-kw. air-cooled mercury-arc rectifier serves coke-oven load formerly supplied by two 150-kw. engine-driven generators; installation is one of earliest applications of new air-cooled rectifier



WIDELY FLUCTUATING d.c. load marks electrical requirements of coke ovens; full scale corresponds to 150 kw.; chart speed 6 in. per hour.

Prior to the installation of the rectifier in June, 1941, direct current had been supplied from three 150-kw. steam engine driven d.c. generators. With only one of these machines in operation it was impossible to maintain voltage stability when the heavy oven equipment—such as the coke pusher—was operating in conjunction with coal-handling bridge crane due to the sudden load surges. Two 150-kw. units were required under most conditions, with one unit as standby. The extremely low load factor (average load/max. demand) occasioned by the fluctuating character of the load made this type of operation costly.

Ability of the mercury-arc rectifier to adapt itself instantly to sudden load changes and to deliver 25 percent overload for two hours and 100 percent overload for one-minute periods recommended it for this type of operation. High operating efficiency, ranging from 78.5 percent at $\frac{1}{8}$ full load to 88 percent at $1\frac{1}{2}$ times full load, and relatively low idling losses, promised economical operation. Voltage regulation with the rectifier was also foreseen to be of the order of 6 to 7 percent compared to no load voltage.

The rectifier installed was a 150-kw. unit of the new forced air cooled type made by the Allis-Chalmers Manufacturing Company. Its six-anode metal tank is evacuated by a mercury-vapor high-vacuum pump and a motor-driven rotary low-vacuum pump. Unit has a total weight of 2,500 lb. Alternating current is supplied to the unit at 233 volts, six-phase, from a 178-kva., outdoor-type, step-down transformer supplied on the primary side at 4,360 volts, three-phase, delta. Rectifier at full load delivers 625 amp., at 240 volts d.c., 1,250 amp. for one minute.

Early operating experience with the unit has borne out preliminary expectations. Average operating efficiency for each of the first four months was respectively 90.83, 85.65, 87.33 and 87.33 percent. The unit is guaranteed by the manufacturers for operation in ambient air at 110 deg. There was some question, when the machine was first installed, whether it would operate satisfactorily in the high temperature air at the coke plant. However, during the second month of operation ambient temperature reached 109 deg. for an extended period and it is now believed that it will not be necessary to use a separate air cooler with the unit as was at first contemplated.

Operating Economy

Analysis of operating costs over the first 113 days of operation show that if present economy continues the installation should pay for itself in somewhat more than two years. Past experience with steam engine generation of d.c. showed a cost of $0.0349 per kw.-hr. including labor, repair, etc. Operating records of the rectifier installation showed for the first four months:

D.c. energy charge, per kw.-hr.	$0.00507
Demand charge	0.00211
Inspection (including cost of standby of generators)	0.011
Gross per kw.-hr.	$0.01818
Saving over d.c. engine generation $0.0349 — 0.01818 = per kw.-hr.	$0.01672

A total of 70,641 kw.-hr. was rectified, in the initial operating period of 113 days. Total saving over this period was therefore $1,275, or an average of $11.29 per day. Estimated annual saving, then, corresponds to $4,120 per year on an investment of $10,400, indicating that the unit will pay for itself out of savings in a little more than two years.

•

Vibrator Breaks Coal Arches

Coal arching over the downspouts at the bottoms of bunker hoppers can cause quite a lot of annoyance in a power plant. To avoid such bother in the Fort Atkinson station of the Georgia Power Company a heavy duty electric vibrator of the kind used on gravel sorting screens is mounted on the outside of each hopper throat. If coal flow stops in any spout the fireman just pushes the vibrator button for a few seconds and the coal starts coming down again.

Combustion Corrections Gain Large Capacity

Designed boiler output (with initial fuel) is recovered by the elimination of erosion and clogging through simple addition of tubes and material-saving changes in economizer

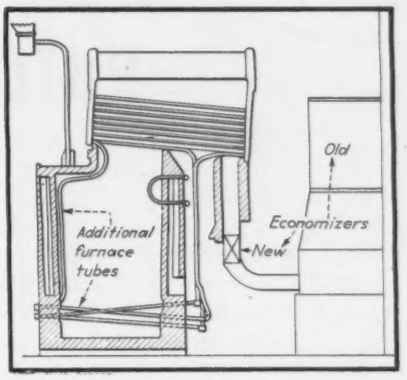


FIG. 1—Better furnace and flue-gas cooling realizes 32 percent increase in capacity. Small new economizer is bigger in performance than its massive predecessor.

"SLAGGING" in sixteen 20-year-old pulverized coal brick-lined furnaces at Lakeside of Wisconsin Electric Power Company limited their maximum sustained output when burning southern Illinois coal because of boiler first-pass clogging and brickwork erosion by molten slag. Fans and all other facilities permitted higher outputs, but high furnace temperatures formed a hampering "bottleneck."

Installation of 37 to 77 percent more furnace heat-absorbing surface removed the slagging limitation definitely. Favorable location of this new surface, principally where rates of heat absorption were highest, would have permitted the burning of more than 37 to 77 percent additional fuel without exceeding previous temperatures. Since other facilities did not permit quite all of this output increase, the furnaces now have a large margin before troublesome slagging.

The eight oldest boiler units were also handicapped by unreliable, inefficient economizers. Their 25 percent air leakage overworked the induced-draft fans and thus limited steam output.

Economizers Conserve Metal

Modern economizers requiring only one-eighth the weight of new materials as that returned to the war effort as scrap (because fins on the new tubes multiplied the tube areas by twelve times) were readily installed in existing ducts.

Output was elevated 32 percent in these older eight units by the two major changes, and 16 percent in the eight other boiler units, by simply the added furnace cooling.

Together, these two relatively minor changes have increased needed boiler capacity the equivalent of at least 35,000 kw. at a cost of about $4 per kw. Perhaps almost equally important to the capacity gain is the fact that vital reliability and gains from lessened maintenance have resulted, plus minor economy improvements.

Summarizing, valuable increased capacity for serving war industries has resulted from a minor expenditure of man-hours, a minimum interruption of equipment service and an actual considerable gain of metals for the war effort.

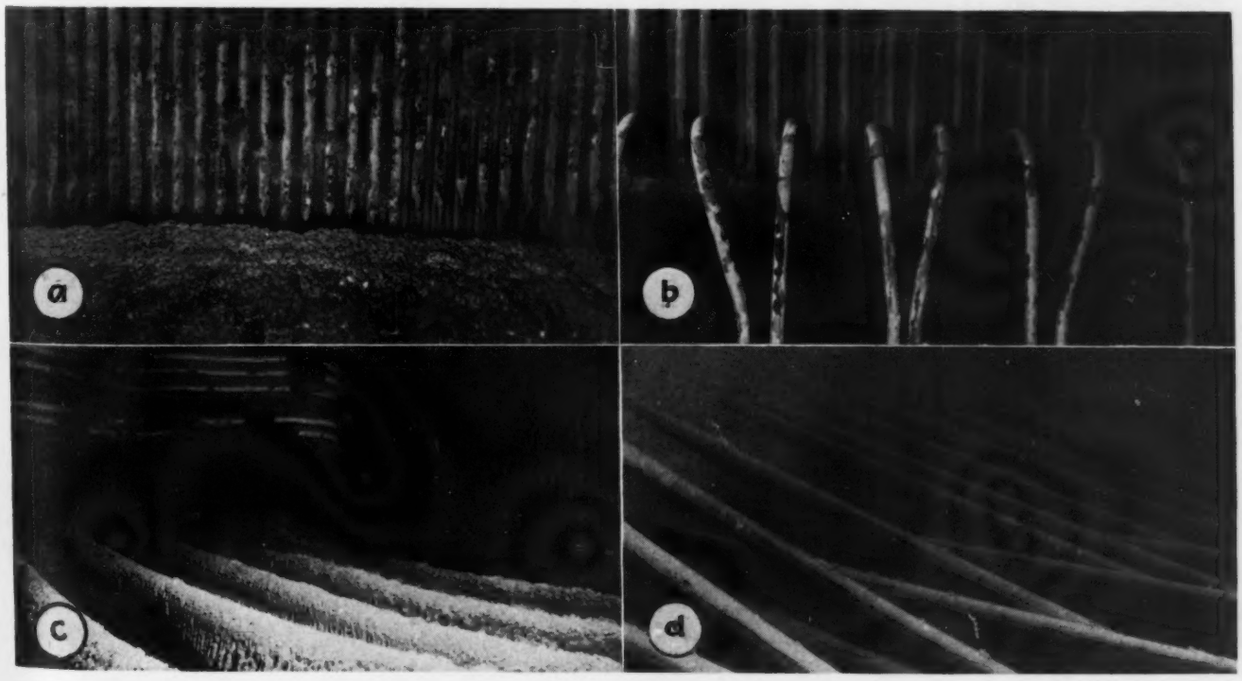


FIG. 2—Slagging naturally grows cumulatively worse; cleanliness sustains itself; marked lessening of clogging and ash insulation effected—(a and b) boiler inlet (first pass) and (c and d) in screen tube areas by means of the changes indicated in Fig. 1

PRIORITIES PROBLEMS

THIS SECTION, which is now a regular feature of ELECTRICAL WORLD, uses the case method rather than the more familiar question and answer treatment because to answer a question intelligently one must know all of the conditions that might have a bearing on the particular problem. Getting this information now in specific applications for priorities is one of the things that delays the granting of ratings in a great many cases.

There are very few hard and fast rules which cover all cases, and for that reason it seemed inadvisable to offer interpretations of a categorical nature. These cases are guides to procedure and indicate what might be expected under certain conditions. Moreover, we believe it will be found most helpful if those who apply for priority assistance have an understanding of how decisions are arrived at and the nature of the guiding philosophy.

However, that does not rule out questions from readers. By all means send in questions. We shall attempt to find a case as nearly parallel as possible and show how that was handled. It might not completely answer the particular question, but it will be a helpful guide.—EDITORS.

Amending Project Ratings

Case No. 5

When original P-200 priority ratings prove insufficient to obtain some of the most critical items of materials utilities have frequently resorted to filing PD-1A applications to get the necessary up-ratings. A recent instance in point involved a substation extension authorized under a P-200 rating. It originally was assigned an A-1-j rating, which proved inadequate for a number of specialty steel and copper items.

A half-dozen separate PD-1A applications were filed for the higher ratings needed to obtain the missing materials from as many suppliers. WPB, however, now forbids the processing of PD-1A applications for up-rating a project rating, so the power division had to route such PD-1A's to its project section to be handled as project amendments.

When the first two PD-1A's in the case cited reached the power division they were started through the mill in this manner. A day or two later another of the applications arrived—after the file in the case had started on the necessary rounds for clearance and approval of a project amendment covering the material listed in the first two forms. The late arrival could not be handled until the first amendment had been issued—with hundreds of priority applications constantly in the process of being reviewed and issued, it is not possible to recall a file once it has started its rounds. After the second project amendment, covering the third PD-1A, had been started on its way, along came the last three PD-1A forms, which similarly had to wait for the return of the file. In all, the utility's various applications were held in a delayed file for more than two weeks; meanwhile, work on the sub-station was at a standstill.

The way to avoid this difficulty is to apply directly for an amendment to the project rating. This is done by letter, to the power division's project section, and all the materials for which special ratings are required can be lumped together. The application then will be handled in Washington by the same man who authorized the project in the first instance. The utility stands a much better chance of getting what it needs when it runs the gantlet only once, instead of two or three times, and the procedure saves both time and paperwork.

Sectionalizing Loads Under L-94

Case No. 6

Limitation Order L-94 directs utilities to determine the availability of non-utility power in their areas and to make any "feasible" interconnections with a view to getting the maximum benefit for the war effort of the installed generating capacity, whatever its source. This, however, does not always mean integrated operation—the controlling consideration of the WPB power division is the ratio of materials required to the kilowatts involved.

Sectionalizing of loads for emergency service by an industrial plant or other power source is expected by the power division to prove an important source of added wartime energy. For example, recently in a power area considered tighter than most, a utility found it could obtain between 1,000 to 1,200 kw. of firm power from a municipal plant with which it had never been connected. The alternatives for connection were parallel operation or tapping the municipal line at a sub-station which feeds an old quarry and sectional-

℞ Here's a tip on how to save some time amid Washington's red tape procedure. When WPB gets a priority application which doesn't contain all the required information upon which to base a rating, the applicant is sent a letter explaining what further data are needed. This letter concludes with the statement that if the requested information is not forthcoming within fifteen days, "it will be presumed that you do not care to pursue the matter further." After fifteen days, the application automatically goes into WPB's permanent file room and is swallowed up among hundreds of thousands of others; several days often are required to get it back. So, if it is not possible to get the necessary reply back to WPB within fifteen days, drop a line to the official who returned the application telling him the answer will be along in a few more days. He will then hold the file on his desk beyond the fifteen-day period.

izing a portion of the utility's load to be served in emergencies from the municipal sub-station.

Installation of equipment for parallel operation was estimated to cost about $15 per kilowatt; tapping the feeder was possible for one-third as much. Inasmuch as $10 worth of materials per kilowatt is considered about tops for connections, except in an actual shortage or other emergency situation, the decision reached in discussions between the utility and municipality with the power division's allocation section was to tap the feeder rather than integrate.

Wherever possible, materials for these L-94 connections are to be obtained under the provisions of Order P-46. When, as in this instance, the material and equipment needed exceeded P-46 limits, the utility applies for the necessary priorities in the same manner as for any other construction—preferably a project rating rather than a series of PD-1A's. The section which handles the priority applications gives full weight to the recommendation of the L-49 staff.

Industrials Chip in

Case No. 7

Here is an example of how a utility company in effect increased its available supply of energy without the use of a dollar's worth of scarce materials.

The utility has a wholesale power contract with a small municipal company. The municipality, in turn, serves two industrial plants which have their own generating stations but operate them normally only for peak demands because costs exceed the city rate. The utility's inquiry under Section B-3 or Order L-94 disclosed that the capacity of the industrial plants is sufficient not only to provide their full needs but also to supply the entire municipal load. Further, the city and the industrials operate in parallel.

In its report to the WPB power division's allocation section outlining its efforts to meet the L-94 provisions, the utility explained that arrangements were made to have the industrials take over the municipal load at any time it becomes necessary for the utility to interrupt the deliveries to the municipality.

Not often, of course, will it happen that an industrial plant can assume an entire system load, but the allocation section feels that a goodly amount of wartime emergency energy can be developed by sectionalizing portions of loads to be carried in emergencies from non-utility sources (see Case No. 6, this issue).

Fewer Condenser Tubes

Case No. 8

Utilities requiring new condenser tubes must supply WPB power division with a detailed justification of their need. Even then, because of the acute scarcity of tubes in relation to demand, ratings are issued only for a "patch and pray" job involving the least possible number of replacements.

Illustrative of this strictness is WPB's cutting down of a recent application from a utility for more than $100,000 worth of Admiralty metal tubes for retubing four large units to about one-fourth the amount requested. The considerations which dictated the decision in this case apply equally to all condenser tube applications.

The original application contained little information beyond a statement that the condensers were badly in need of repairs and that the company engineer felt a retubing job advisable. The power division wrote a letter suggesting that retubing of two of the units be deferred—this was because the utility is not in an overloaded power area—and asking for data showing how many tubes had been plugged and how many cut out in the units selected for overhaul now; also, how many tubes might be in stock. Data also was requested showing recent operating experience with the condensers, and the unit load factors.

This information is required before a rating is given because WPB limits tube replacement to a maximum of 80 percent of the original surface, usually less for machines not carrying base loads. If 30 percent of the tubes have been plugged, not more than 10 percent of new ones will be authorized; if there are any tubes in stock, this number is deducted from the allowance.

Important also, but not a factor in this case, is to specify in the application the kind of water used in the condensers. WPB has limited manufacture of condenser tubes to Admiralty and Muntz metal and the power division requires that Muntz metal be used where there is a fresh water supply, reserving Admiralty for salt or brackish water.

A-1-c for Anticipating Breakdown

Case No. 9

Frequently, utilities unnecessarily file PD-1A priority applications with WPB's power division to get materials needing up to an A-1-c rating which they need in stock as advance precaution against serious breakdown. An example is the recent application of a mid-west utility for a small (dollar-value) order of valve repair parts for the company's main station.

The power division in returning the application pointed out that P-46, as amended June 23, in section (b) (1) (v), permits utilities to self-assign A-1-c ratings up to 30 percent of their orders to obtain materials to repair actual breakdown on existing equipment "or to make reasonable advance provision for such repair." Thus, instead of filing a PD-1A for an A-1-c rating to get the valve parts, the utility could simply assign this rating to its order upon the supplier.

Only when a utility has used up its 30 percent A-1-c allowance in any quarter and still needs breakdown repair parts does the PD-1A application become the proper procedure. In that event it should be stated on the application that the P-46 quota has been used up.

When filing a PD-1A application for a rating to obtain materials for making a service extension outside the scope of the Form PD-545 procedure, it is essential, in addition to answering the questions asked on the blank, to furnish also the information that the job complies with relevant conditions set forth in the various administrative letters of the power division. For instance, a utility seeking to extend service to a new building should report that the building foundation was completed by March 26, 1942. Or, if a third wire is needed to serve a range or water heater, include on the PD-1A form the date the equipment was installed. Many PD-1A's are being delayed from one to three weeks while the power division solicits this information by letter from the applicants.

Valve Closure Assured if Penstock Fails

Maximum operating reliability obtained by installing oil-actuated mechanism which protects penstock and power house in case of pipe line break — Device functions automatically or manually

EARLE A. CRELLIN, Pacific Gas & Electric Company*

SHUT-OFF VALVES in the penstock lines of several Pacific Gas & Electric Company hydro plants have been equipped with hydraulic operating mechanisms so as to insure maximum reliability of operation and at the same time afford maximum protection to penstocks and power plants under emergency conditions. This is accomplished by provision for automatic closure of the valves whenever the velocity of the water in the penstocks exceeds, by a predetermined adjustable margin, that of normal full load flow. The mechanism also is arranged to permit closure from the power house. Opening of the valves after full closure, however, cannot be accomplished except by manual control at the valve, thus insuring protection against accidental opening into an empty or insufficiently primed pipe line. Three typical installations are described below.

Butterfly valves in the penstocks of the Bucks Creek and Potter Valley power houses are equipped with mechanisms actuated by oil stored in headtanks sufficiently high above the valve houses so that adequate pressure is available at the point of application. Oil is used because of its lubricating and non-corrosive qualities and because of its freedom from freezing at all temperatures likely to occur at either plant. Interconnecting piping between the headtank and valve houses is buried or otherwise protected against mechanical injury; hence the ever-present force of gravity is available for operation of the valves. At the Halsey power house the two sluicegates at the outlet of the forebay, which control the admission of water into the penstocks, are operated by hydraulic cylinders and an oil pressure system.

Principal elements of the control system vary with each installation, dependent upon the valve to be operated. At Bucks Creek the initiating equipment in the automatic closing device on each of the two penstocks consists of two pairs of pitot tubes installed in the sides of the penstock, one pair located 4 ft. 3 in. downstream and the other pair 9 ft. upstream from the center line of the main butterfly valve. Duplicate tubes are installed in case one should become clogged with a bit of debris in the water. These pitot tubes take advantage of the loss in head or drop in pressure in the water as it flows through the valve and around the disk. This pressure drop increases rapidly with increasing velocity of water through the penstock.

Tests were conducted to determine the pressure differential corresponding to normal load (180 c.f.s. of flow and 3 in. of mercury). To provide an ample margin against tripping by penstock surging or for other reasons not induced by a sustained increase in velocity of flow, the device was set to trip at 6.8 in. of mercury, corresponding to a penstock flow of 295 c.f.s. or 64 percent above full load. Fig. 1 shows the arrangement of the tripping equipment in the valve house at the head of the penstock; Fig. 2 shows a layout of the essential elements.

Remote Tripping

In this installation remote electrical tripping is accomplished by operating a push-button switch in the power house. Coupled with the tripping is a position-indicating hook-up which is so arranged that the operator in the power house will receive an indication that the electrical tripping impulse has reached the tripping solenoid and he will thereafter be able to observe the closing travel of the valve to the fully closed position—an operation requiring four minutes. The position indicator consists of a 4-amp., d.c. ammeter and a variable rheostat connected in series with the coil of the tripping solenoid and the push button. The rheostat is rotated by a sprocket-and-chain connection to the main shaft of the butterfly valve and is so arranged that all of the resistance is out of the

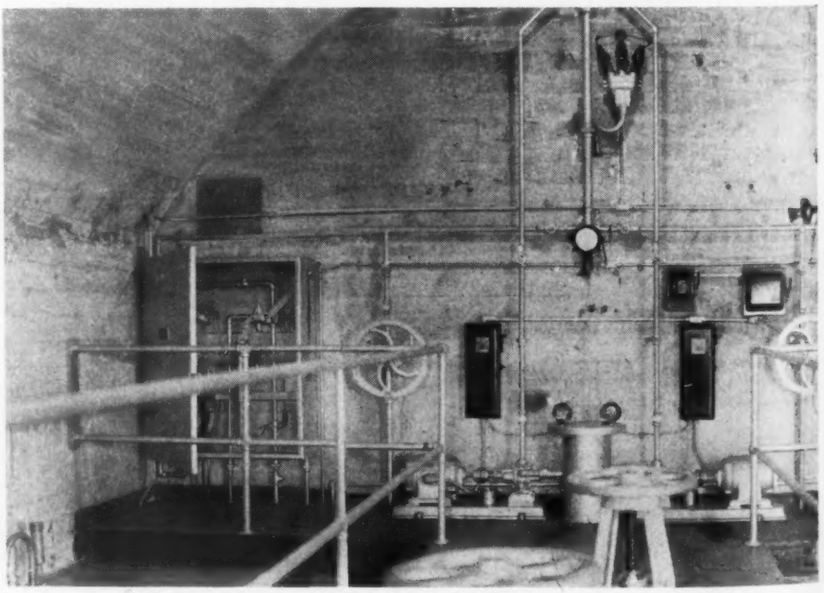


FIG. 1—Interior of valve house at head of Bucks Creek penstock showing equipment for hydraulic operation of butterfly shut-off valves

* Assistant Engineer of Maintenance.

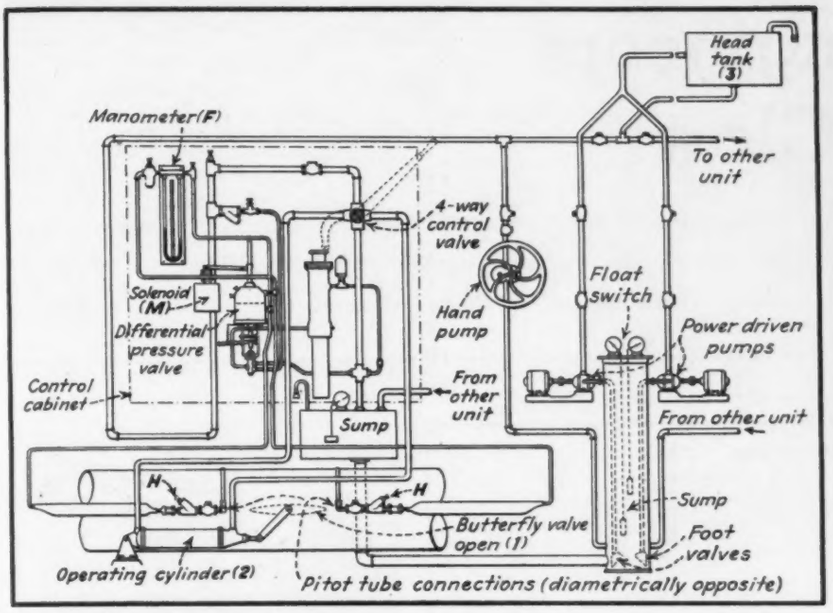


FIG. 2—Layout of control equipment for main butterfly valves at Bucks Creek

The valve (1) is actuated by a hydraulic cylinder (2) which receives oil under pressure from the headtank (3). Pitot tubes (H) develop a pressure differential which registers on the manometer (F). When velocity exceeds predetermined limits the differential pressure valve functions, releasing oil through four-way valve to the operating cylinder. Remote control operation from the power house is through the solenoid (M) to the pressure valve. Oil from the operating cylinder after a closure is forced by the opening cycle into the sump. Duplicate motor-driven pumps controlled by float switch return the oil to the headtank. The hand pump is for emergency use.

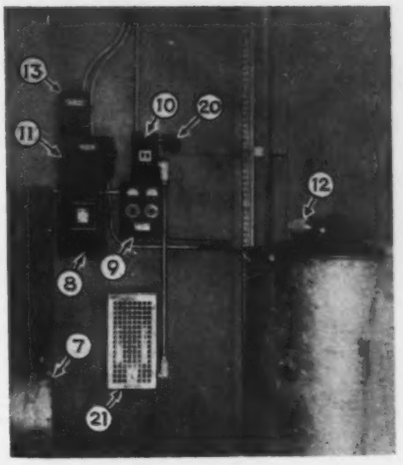


FIG. 3—Actuating mechanism for automatic control of sluice gates at Halsey

When abnormal difference in water level on the recorder (12) closes the contacts, the circuit is completed through the closing coil of the contactor (11) and the 24-volt storage battery (7) to energize the solenoid trip on the sluicegate. On manual operation when the push button in the power house is depressed the closing coil of the contactor (13) is energized. This is connected in parallel with the recorder so that the same sequence of events occurs as though the recorder actuated the mechanism. An electric heater (21) thermostatically controlled (20) keeps temperature above freezing in winter. A selenium rectifier (9) maintains the battery at full charge.

circuit when the valve is fully open.

The resistance of the circuit is such that a current of approximately 3 amp. will flow when the push button is depressed to supply a potential of 125 volts from the station storage battery. Closing of the circuit deflects the ammeter needle to the "open" position and energizes the tripping solenoid. As the butterfly valve rotates to the closed position, the arm of the variable rheostat also moves, thus introducing resistance into the circuit until at the closed position the current value is reduced to 1 amp. with 125 volts applied to the circuit. Thus by depressing the button from time to time the operator can observe the progress of closure at any time during the four-minute cycle.

An alarm system has been provided to direct the attention of the operator to loss of oil pressure. Before opening the butterfly valve after closure it is necessary to refill the penstock in order to equalize pressures.

In the Potter Valley installation the actuating mechanism for automatic closure of the single butterfly valve consists of two piezometer rings —one 180 ft. upstream from the valve and the second in the penstock 12 ft. 10 in. downstream from the valve. The same system of pressure differentials is employed, functioning through a balanced four-way differential piston valve which controls the oil to the operating cylinder.

At the Halsey power house water to the penstocks is controlled by two sluicegates, each of which has a 12,300-lb. gate leaf, 4x6 ft. The gates close by gravity, being released by a latched tripping mechanism which is controlled by water level differential for automatic closure or by push button for manual operation from the power house. Two hydraulic cylinders with an oil pump are used for opening the gates. These cylinders also serve as a dash pot to regulate the speed of closure after tripping. The gate house installation is shown in Fig. 3.

Initiating Element

The initiating element for automatic operation is a water level recorder provided with an adjustable high-level electric alarm contact. It is installed in the gate house on the top of a pair of float wells and is actuated by a differential float system which causes the instrument to respond to differences in water level in the two float wells regardless of what the water level in the forebay may be. One of the float wells is connected to the forebay and the other to a point in the outlet tunnel approximately 100 ft. downstream from the sluicegates by a 2-in. brass pipe. This well therefore is affected by the flow of water in the tunnel, which produces a reduced pressure at the open end of the pipe pointing downstream and magnifies the actual velocity head losses.

When a flow of water in excess of the normal full load rate passes through the tunnel the difference in water level in the float wells increases rapidly. By previous test the water level recorder has been set to function on a differential corresponding to 600 c.f.s., as compared with the normal full load flow of 500 c.f.s.

As with the other installations, this one is equipped with a position indicator for use with the electrical tripping circuit from the power house.

Expense of these installations is nominal in comparison to the protection afforded to the investment in power houses. Equipment is inspected and tested monthly. While there have been no penstock breaks to test the installations, the equipment—powered by gravity—stands always ready to meet any emergency.

Lighting Engineers Study Sky-Glow

Massachusetts electrical men co-operate with U. S. Army and public officials in analyzing dimout problems related to costal defense — Instrumental methods interpret test blackout conditions

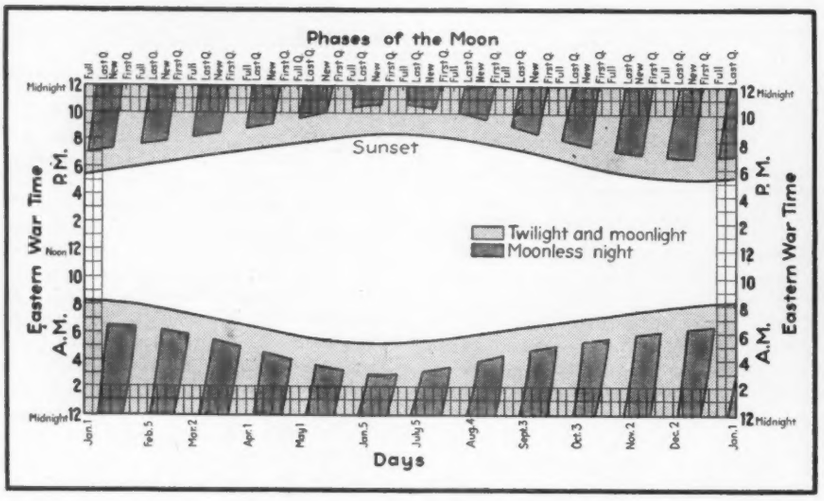


FIG. 1—Sunrise and sunset curves with twilight and moonlight duration bands for Boston in 1942

FIG. 2—Taylor low-brightness meter in special mounting for field tests of sky-glow

HOW DIM is a dimout? How high is the sky-glow? These and many other puzzling questions resulting from army regulated dimout lighting may soon be answered. At least the whole matter has been recently studied and a report prepared by lighting engineers of the Massachusetts Committee on Public Safety.

Important emphasis was placed on the effect of natural conditions as a factor in determining how effective present dimout measures are, or possibly can be. In the area under test it was found that about 2,200 of the 4,303 hours annually from sunset to sunrise are significant in the control of sky-glow over coastal cities and towns (Fig. 1). In the remaining time the presence of moonlight and fog cancels out the sky-glow. What little scientific data are available on the subject of visibility under low background brightness indicate that silhouetting of vessels is possible under natural conditions on the darkest of nights, and without benefit of artificial sky-glow from cities. A reduction of sky-glow affects the distance at which ships can be seen by silhouette; hence the problem is somewhat localized.

The principal feature of the study was a series of tests designed to determine the magnitude of sky-glow, the relative effect of various contributing components and its effective distance inland. Tests made:

1. Continuous nightly measurements around the compass from three locations in eastern Massachusetts, one station at sea, the two others on land. The stations were in direct line, the middle station at the center.

2. A progressive blackout of the eastern half of the state in five steps using the above test locations and starting 1 a.m. in order to eliminate most of the contribution from residential, commercial and automative lighting.

3. Tests over an undimmed-out city using two test stations on either side of the area in direct line with its center and equidistant from it. A progressive blackout was arranged in eight steps, namely, outdoor signs, show windows, upright street lights, pendant street lights, radial wave street lights, automotive headlights, residential lighting and defense plants. Observers checked load density and traffic was counted.

4. Tests over a dimmed-out town during a progressive blackout of four steps as follows: Ornamental street lights reduced from 6.6 amp. to 5.5 amp., ornamentals off, radial-wave street lights off, general blackout residential, commercial, etc.

All tests were made with Taylor low-brightness meters (Fig. 2). The technique employed by the Massachusetts engineers was unique in that for the first time measurements were made simultaneously from two or more points, one or more being on shore. Heretofore a single station at sea had been utilized. The latter practice had the obvious advantage of relating results to visibility from an enemy craft, but proved inadequate as a sole means of analyzing the causes of sky-glow. On the night of the most extensive test blackout of eastern Massachusetts the measurements taken at sea were useless be-

cause of haze which obscured the sky-glow completely. Measurements on land were unaffected by the haze and gave the desired information.

Another important point to be observed by any one wishing to repeat these tests in other localities is that all tests were made in the dark of the moon. Under such conditions the effect of sky-glow is most pronounced and in any event the presence of moonlight may make any readings meaningless. Where sky-glow from shore installations was observed on a moonlight night it came from unshielded lighting of war industries, indicating a brightness several times that of dimmed-out cities. It is understood that such conditions can and will be corrected compatibly with production and protection.

30-Mile Optimum Dimout Zone

Detailed discussion of the results of the study cannot be given for obvious reasons. However, it can be said that in no case was it possible to measure sky-glow from points beyond 25 or 30 miles. A dimout zone of this depth would seem to be reasonable in this area. The tests of the isolated cities were most interesting and useful. In each step of the progressive blackout reduction in sky-glow was measurable and indicated the relative contribution of various sources. Automotive lighting and war plants were found to be important factors, and suggest where corrective measures might be applied. A single automobile produced enough sky-glow during the test of the dimmed-out city to prevent measurement at one step. On this particular night the sky was dark with heavy clouds and the effect of headlights was striking.

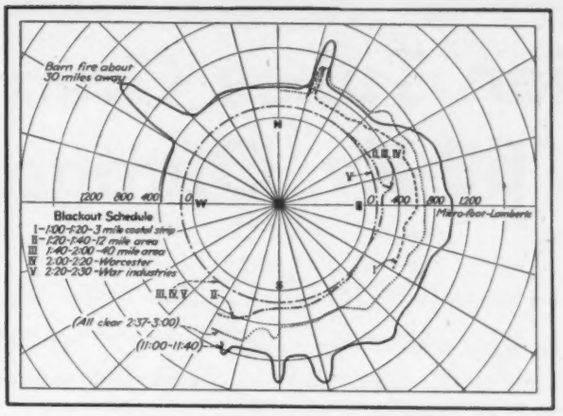


FIG. 3—Variations in sky-glow during night of progressive blackout (July 13-14, 1942). Readings taken at a point about 12 miles inland from Boston coastline

To assist in analyzing test data three types of graphs were employed. Typical illustrations are shown in Fig. 3, 4 and 5. The polar curve (Fig. 3) was useful in plotting data from land stations and in identifying sources of sky-glow around the horizon. Fig. 4 indicates the variation of sky-brightness sweeping across the city of "X" under test during each step of a progressive blackout. Fig. 5 shows the percentage drop in sky-brightness at each step of the progressive blackout in the town of "Y".

The Massachusetts study was undertaken at the request of local army authorities as a means of determining the effectiveness of present dimout methods and to indicate where and how further modifications in existing regulations might advantageously be made. The data, together with recommendations of the Technical Blackout Committee which made the study, have been turned over to the army.

Col. Harold Storke, provost marshal of the First Service Command, represented Maj.-Gen. Sherman Miles, commanding the First Corps Area, in carrying out the sky-glow studies. Signal corps civilian employees were assigned to assist in obtaining the test data. Considerable credit is due to Col. Storke and to state and local civilian defense organizations for the cooperative and efficient manner in which each phase of the test was conducted. Without such co-operation the study would have been futile.

Lighting engineers of the Massachusetts Technical Blackout Committee, responsible for these studies were: R. B. Brown, Jr., Boston Edison (and president-elect I.E.S.); P. N. Clarke, Westinghouse Electric; C. A. B. Halvorson, General Electric; A. S. Walker, New England Power System, and Moorhead Wright, Jr., General Electric. Other committee members included C. J. Farley, secretary Massachusetts Blackout Committee; A. W. Devine, assistant to the Motor Vehicle Registrar; Page Browne, superintendent Park Square Building, Boston; I. B. Parkhurst, assistant business manager Harvard University, and W. W. Thompson, consulting engineer, Boston, and chairman of the Technical Blackout Committee (temporarily absent from the state).

New England power engineers contributed valuable data on natural conditions and were responsible for the graphic chart of Fig. 1. Laboratory technicians of the Boston Edison and General Electric companies supervised and manned the test stations and devised methods of presenting and interpreting the data obtained.

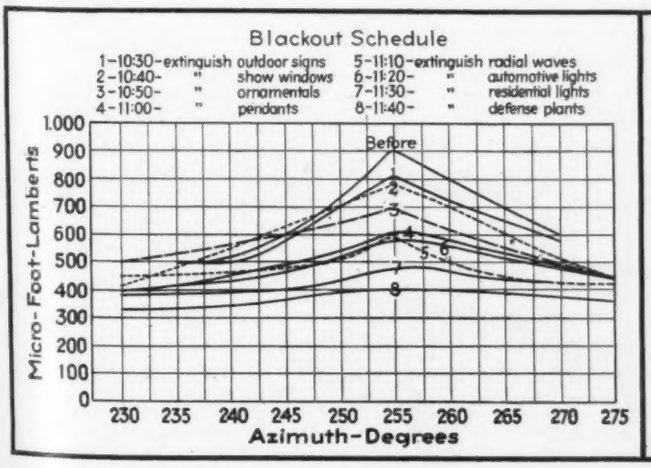


FIG. 4—Horizontal brightness variations showing effect of progressive blackout on sky-glow of an undimmed out Bay State city "X" in test of July 15, 1942

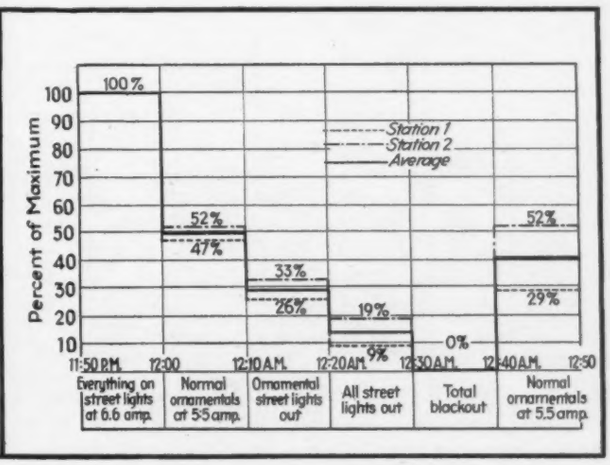


FIG. 5—Percentage of sky-glow variation effected by blackout steps in the Massachusetts town of "Y" throughout the night of July 17-18

Expulsion Tubes Greatly Reduce 66-Kv. Outages

Some 5,000 tubes on more than 200 miles of 66-kv. lines cut outages from 30 to 3½ per 100 miles per year — Protection provided for 98 percent of mileage

W. O. SMITH,* Chief Dispatcher, Long Island Lighting Company

INSTALLATION of more than 5,000 expulsion tubes on the Long Island Lighting system has been effective in reducing the number of outages per 100 miles per year from 30 to 3.5 over a five-year period. Their service life has not been long enough to permit accurate estimate of their expected life, but it has been established that periodic maintenance is essential if such favorable results are to be expected of the tubes as a sustained performance.

In general it has been found that the principal cause of tube tracking with subsequent tube flashovers has been due to accidental shortening of the external series gap below the desired minimum. System outages, with which misperformance of protector tubes is involved, may be of longer duration than those occurring on a line not equipped with the protector tubes. Successive discharges caused by multiple lightning strokes should be considered when determining the limitation of tube life from internal erosion.

*Excerpts from paper submitted in E.E.I. paper contest for one of the James H. McGraw prizes.

Tubes Decided Upon

In 1935 it was decided to take steps necessary to reduce outages on the 66-kv. system (Fig. 1) caused by lightning. In 1934 the total number of faults on this transmission system caused by lightning reached an all-time peak of 65.

Based upon actual field tests made on April 23 and 24, 1935, special expulsion tubes were designed by the General Electric Company for application to the Long Island Lighting Company's System. Also, a study of the fault currents was made for different parts of the system and, based upon a fault current profile, the system was divided into several zones of different fault current ranges, as follows:

Miles From Glenwood	Section	R.M.S. Amps. Tube Current Rating
0-14	Glenwood to New Bridge Road	900/5,000
9-22	East Garden City to Far Rockaway	600/3,400
14-18	New Bridge to Melville	600/3,400
18-50	Melville to Manorville	400/2,500
50-77	Manorville to South Hampton	200/1,100

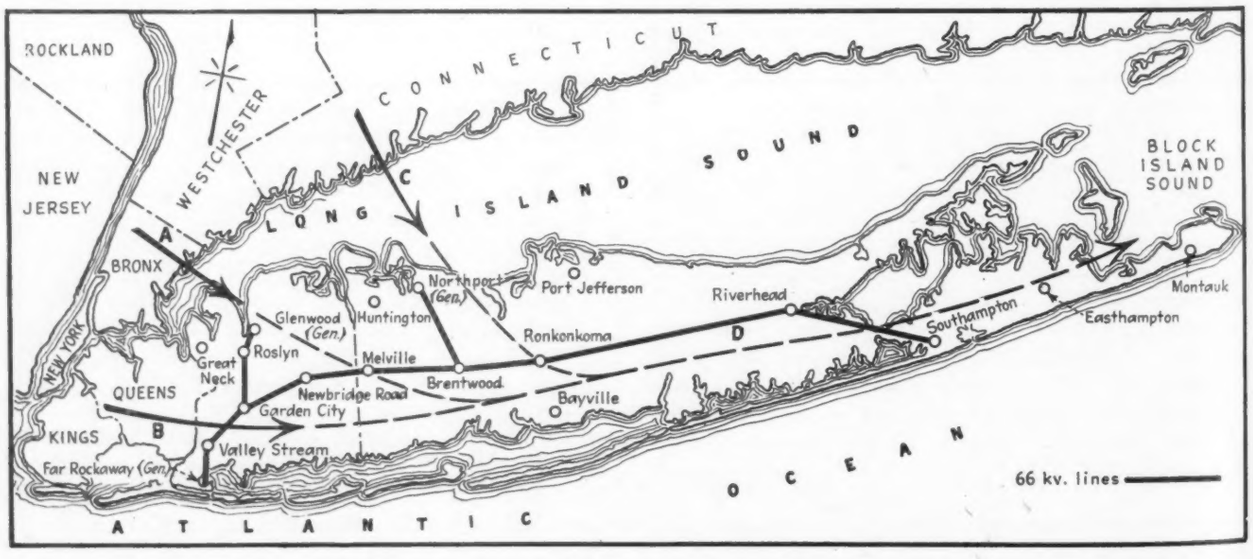


FIG. 1—Double-circuit lines in vertical configuration have single overhead ground wire. Lightning storms usually take one of three paths indicated

Accordingly 2,838 tubes of 69-kv. rating were obtained in 1935, 342 tubes in 1936 and 2,045 tubes in 1937.

With the exception of a few special cases, the types of mounting used with these tubes are:

Type of Tower	Type of Mounting
Suspension	Counterweighted
Strain	Rigid

With the exception of approximately 4 miles, this 66-kv. transmission system was fully protected by tubes in the year 1937. The section not protected by tubes consisted of a wood-pole section between East Garden City and West Hempstead substations.

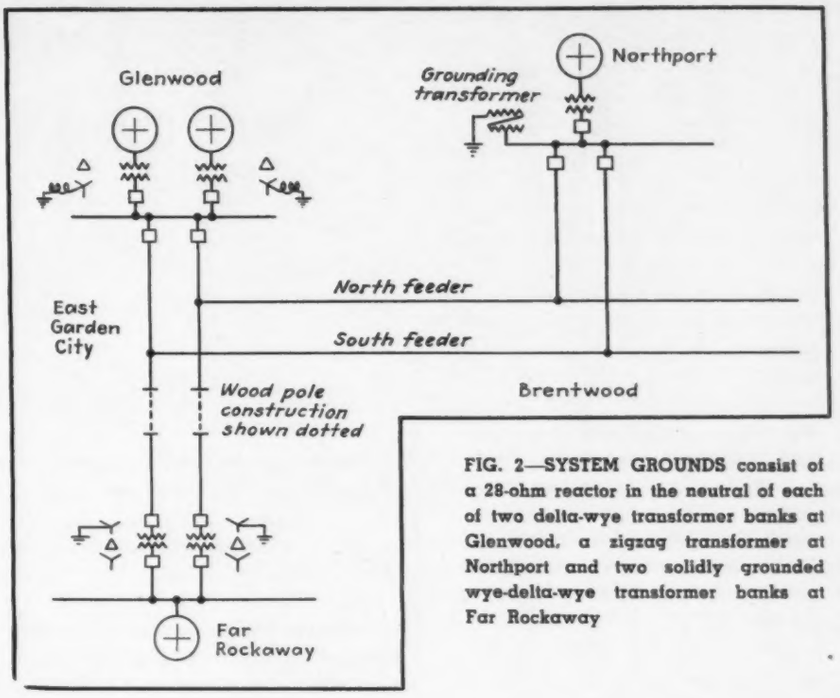


FIG. 2—SYSTEM GROUNDS consist of a 28-ohm reactor in the neutral of each of two delta-wye transformer banks at Glenwood, a zigzag transformer at Northport and two solidly grounded wye-delta-wye transformer banks at Far Rockaway

Storm Characteristics

Curves shown in Fig. 3 indicate the effectiveness of the tubes. Certain facts have been discovered as follows:

(a) In general, a large percentage of thunderstorms originate in the northwest, west and southwest and follow certain paths (Fig. 1).

(b) The most severe lightning storms occur during periods of high tide. In most cases where storms originate during low tide periods the storms either (1) appear to remain stationary at the point of origin and wait for a change of tide, (2) pass over Long Island as a high storm traveling at a high rate of speed or (3) break up and disappear (or change course).

(c) Wind velocity and speed of storm appear to have little or no bearing upon the capacity of a storm to create lightning disturbances on this 66-kv. transmission system.

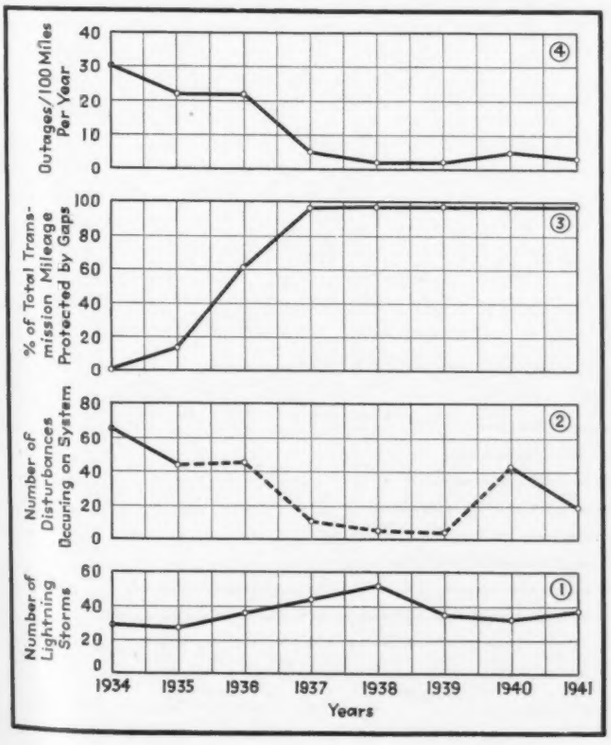
(d) The one characteristic of a storm that can be depended upon to cause disturbances on the transmission system is severe lightning between cloud and earth.

(e) In cases where lightning troubles on the line have been experienced, severe lightning storms have been observed at several observation locations at the same time.

Tubes Effective

Use of tubes materially reduced outages on this transmission system (Fig. 3). The number of outages per 100 miles per year was reduced from 30 with no tubes installed to an average of 3.5 over a period of five years with 98 percent of the total transmission mileage protected by tubes. The portion of the curve between the years 1937 and 1941 includes three outages caused by actual

FIG. 3—Minimum of 25 storms in 1934, maximum of 51 in 1938. No real reduction in outages occurred until a large portion of the total transmission mileage was protected by tubes



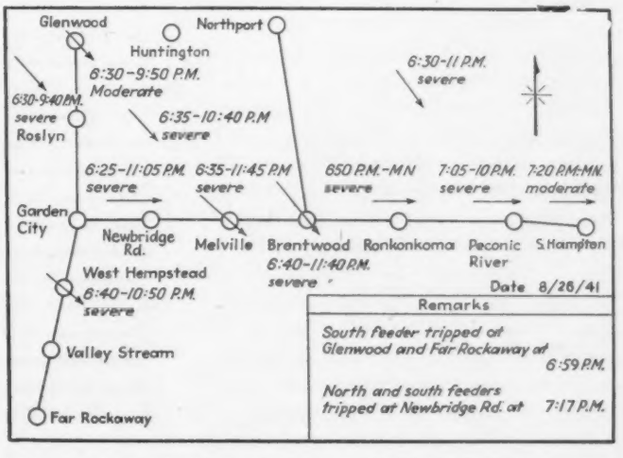


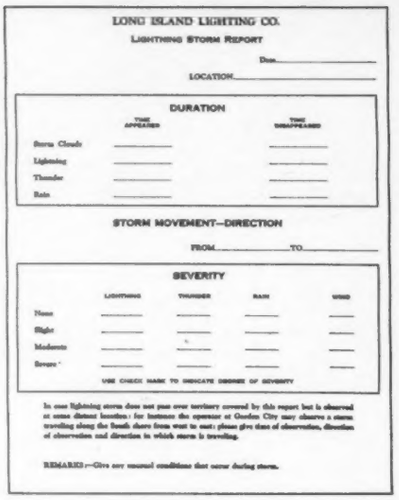
FIG. 4—Record kept of storm data filed by division operators

tube failures occurring during lightning storms. Other outages caused by improper tube operation at times when no lightning storms were visible will be discussed later.

During the year 1940–43 disturbances were recorded on the oscillograph during lightning storms and in the year 1941 nineteen disturbances were recorded. Of the 43 disturbances occurring in 1940 the time interval between successive disturbances, in 36 instances, was greater than one minute. Therefore, if it is assumed that there were no tubes installed in 1940, and that each of these disturbances would have caused an outage, then, since breakers are reclosed in less than one minute in most of the transient disturbances, the outages per 100 miles per year for 1940 would have been 23.5 and not 5.5 as was the case with tube protection. If this reasoning is applied to the disturbances recorded for the year 1941 the outages per 100 miles per year would have been 10.8 and not 2.5 as was the case with tube protection. It is realized that since the impulse discharge voltage of the expulsion tube is lower than that of the insulator it is possible to have a disturbance cause a tube to operate that would not cause an insulator to flash over if there were no tubes installed. However, judging from records obtained before tubes were installed, it is felt that the most of these disturbances would have caused outages had not tubes been installed.

Improper Tube Operations

After 98 percent of the total transmission mileage was protected by tubes an average of 3.5 outages per 100 miles a year occurred each year. Approximately 50 percent of these outages can be traced to improper tube operation, insulator failures on substation and generating station buses and failure of lightning arresters. The remaining 50 percent, even though no concrete evidence is available, is assumed to be caused by flashovers on the small section of line not protected by tubes and to possible improper operation of expulsion tubes. In the latter case it is felt that multiple stroke lightning may have had some effect upon the improper operation of the expulsion tubes (Fig. 6). However, in a large number of cases, no outages were


LONG ISLAND LIGHTING CO.

LIGHTNING STORM REPORT

Date_____

LOCATION_____

DURATION

	TIME APPEARED	TIME DISAPPEARED
Storm Clouds		
Lightning		
Thunder		
Rain		

STORM MOVEMENT—DIRECTION

FROM_____ TO_____

SEVERITY

	LIGHTNING	THUNDER	RAIN	WIND
None				
Slight				
Moderate				
Severe				

USE CHECK MARK TO INDICATE DEGREE OF SEVERITY

In case lightning storm does not pass over territory covered by this report but is observed at some distant location; for instance the operator at Garden City may observe a storm traveling along the South shore from west to east; please give time of observation, direction of observation and direction in which storm is traveling.

REMARKS:—Give any unusual conditions that occur during storm.

FIG. 5—Operators report to chief dispatcher on storms in their areas on these forms

experienced where the expulsion tubes were called upon to clear successive discharges properly.

Analysis of system outages caused by improper expulsion tube operation brought out several important facts, as follows:

1. Outages caused by improper tube operations are more serious than their numerical frequency would indicate, since these outages are usually of long duration.

2. An inspection of approximately 100 tubes showed that there were no factors tied up with any special type of mounting or circuit which could account for the misperformance. More cases, however, were noted on the tubes located on five-unit insulators than on six-unit insulators. It is felt generally that the principal cause of improper tube operation is a too short external series gap, rather than any fault with the tube itself, which starts tracking on the surface of the tube. Some cases of too short an external gap may have occurred due to a hurricane experienced over portions of the line and possible change of conductor sagging. Only a too short external gap could allow intermittent or continuous line voltage applied to the tube and the resulting tracking progressively increases to cause tube flashover during wet or foggy weather.

3. Further inspection of these 100 tubes suggested that enough time has not elapsed since the original installation to predict accurately the expected life of these tubes. Many of the tubes inspected have been in service for five years and none show any indication that, as a result of weathering, they are approaching the end of their usefulness.

Outages associated with improper tube operations are as follows: Three in 1937, two in 1938, five in 1939, six in 1940 and two in 1941. In 1941 the series gap of the expulsion tubes was increased to 7 in. on the six-unit insulators and 6 in. on the five-unit insulators.

Inspection of the two tubes that failed in 1941 showed one to be badly burned and the other blown apart with no evidence of burning. Since several foggy weather periods existed during the year 1941 and no outages were experienced during these wet conditions, it is felt that increasing the external series gaps prevented tracking on these tubes.

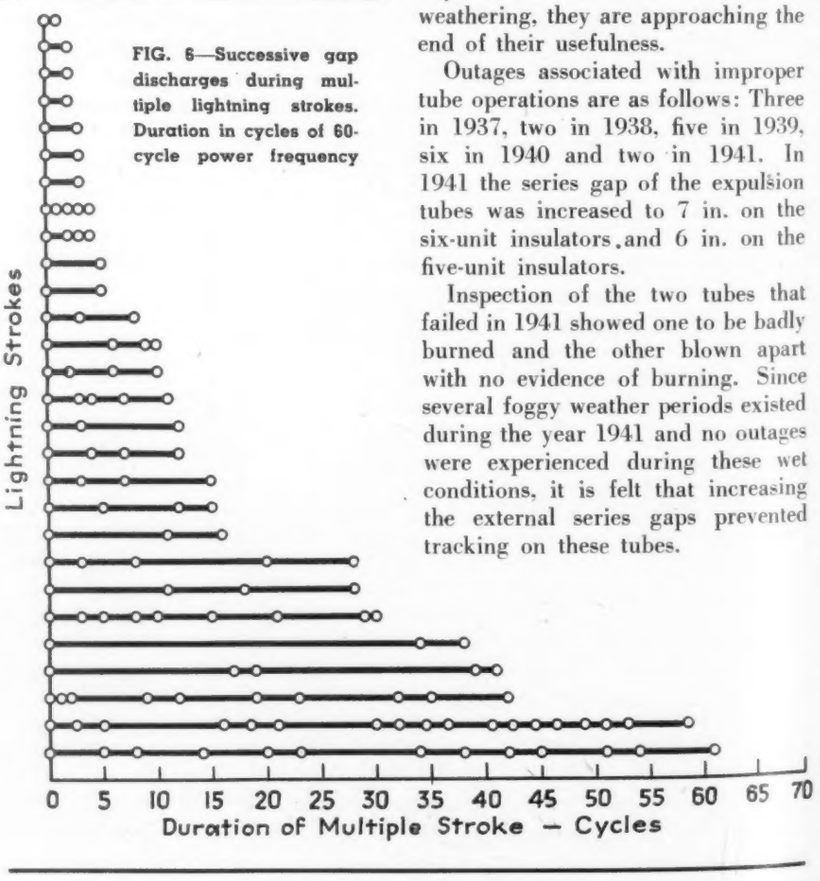
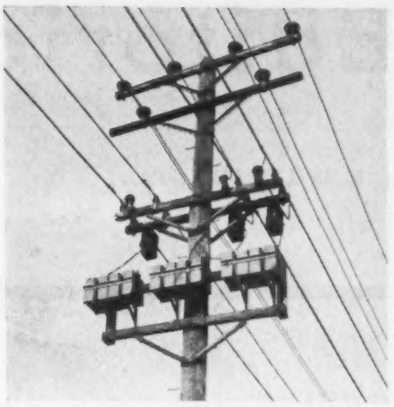


FIG. 6—Successive gap discharges during multiple lightning strokes. Duration in cycles of 60-cycle power frequency

Capacitors Preferred to Machine Reactive

St. Louis installs 25,000 kvar. of pole top capacitors to supply reactive shortage at Cahokia station—Proves more desirable than synchronous condenser of equal rating at plant

GEO. P. GAMBLE, R. C. MORRIS and A. W. HOWELL
Union Electric Company of Missouri, St. Louis



A SHORTAGE of reactive generating capacity at Cahokia generating station, instead of the more usual reasons of voltage improvement and load reduction, is responsible for the recent purchase of 25,000 kvar. in pole-top capacitors to be installed by the Union Electric Company of Missouri during the first half of 1942. Although the purpose of the installation is to supply reactive deficiency at Cahokia, the capacitors are being located remote from the plant on 2,400/4,160-volt distribution circuits which take their supply therefrom.

As will be explained, remote location of these capacitors is expected to reduce the reactive requirement at the plant 28,750 kvar., instead of 25,000 kvar., by virtue of the reduced exciting reactive that will accompany the reduction in loading on associated distribution, substation and subtransmission circuits.

When the Cahokia plant was in the process of development (in the 1920's) it was more economical to install reactive capacity in the form of synchronous condensers than to purchase low-power-factor generators of large rating. As a result the plan was to install relatively high-power-factor machines and supplement them with synchronous condensers when and if the system reactive requirements should make it necessary. Accordingly, the five generators that were installed prior to 1929 were all high-power-factor machines. However, the plant was brought to its ultimate capacity of 300,000 kw., at an average power factor of 87 percent, by installing a 75,000-kw., 80 percent power factor unit in 1937.

This rated plant power factor of 87 percent compared with a load power factor of 75 percent. Although the apparent power factor of the load has been improved to about 80 percent by the installation in recent years of 25,000 kvar. in static capacitors on the distribution circuits, present load conditions still make it necessary to transmit reactive capacity from other plants into Cahokia, even though the Cahokia generators are operated at full field. This operating condition not only results in limited voltage control and increased losses, but the failure of the 75,000-kw., 80 percent power factor generator at Cahokia would have resulted in a shortage of approximately 25,000 kvar. in reactive capacity at the time of the 1941 summer peak, even though ample kilowatt reserve was available at the time. This 25,000 kvar. shortage does not exist during the winter and spring of this year due to the inherently better power factor of these loads.

System Capacity Released

As stated, about 25,000 kvar. in capacitors had already been installed on St. Louis distribution circuits since the company pioneered the extensive use of static capacitors on distribution circuits in 1935. Voltage improvement and capacity released on the distribution circuits were used as the principal justification of these units, but, as was pointed out at that time,* the installation also resulted in the release of substation and subtransmission capacity and a reduction in the reactive requirements at Cahokia. The reactive that was supplied to the system by the installation of this 25,000 kvar. in static capacitors, along with the extra 16,000 kvar. that was added by installing the 75,000 kw. generator at 80 percent rather than at 90 percent power factor, made it possible to postpone the installation of two 50,000-kva. synchronous condensers for which earlier plans had been laid. As a matter of fact, it now appears that the capacitor installation contemplated will add sufficient additional reactive capacity to make it possible to abandon entirely the plans for the synchronous condensers.

**See "Shunt Capacitors on Distribution Circuits," by G. P. Gamble and F. M. Starr, General Electric Review, October, 1936.*

Expected Gains

Improvements expected from the additional 25,000 kvar. in capacitors to be installed on distribution circuits, as compared to a synchronous condenser of equal rating which might be located at the power plant, may be briefly listed as follows:

1. Will increase load-carrying ability of subtransmission, substation and distribution circuits by approximately 16,000 kva., due to straight load current reduction.
2. Will effect substantial additional increase in load-carrying ability of distribution circuits due to reducing voltage drop along these circuits; the effect stressed in paper referred to.
3. Will effect a reduction in the reactive requirement at the generator of approximately 28,750 kvar., instead of 25,000 kvar. This extra 3,750 kvar. is the reduction in exciting reactive (I^2X) that results from reduced loading on the distribution, substation and subtransmission circuits, the effect recently pointed out by M. C. Miller of Ebasco Services, Inc. It should be noted that the additional 15 percent reduction in reactive requirement that will result in this application is relatively low because of the low reactance of the subtransmission and distribution circuits supplied out of Cahokia plant.
4. Will have appreciably lower operating losses and effect substantial additional reduction in system losses.
5. Will have approximately the same installed cost, lower operating cost and require no spare equipment.
6. Will involve no sacrifice in control of plant bus voltage in this application, because the reactive requirements of the load on the Cahokia plant exceed 50,000 kvar. minimum, and as a result the capacitors can be considered as base reactive, while the generator reactive thus released may be varied for voltage control.

Editorials

S. B. WILLIAMS, *Editor*

Is Rate Regulation to be Scuttled by OPA?

THE ENTRANCE OF OPA into the field of utility rate regulation is very disturbing. So far the mere request of the price ceiling agency to become a party in any proceedings for rate increases has been very effective. The anti-private power bloc, however, has already drawn up legislation to amend the act so that OPA may have veto power over all rate increases. There is, furthermore, a growing unrest over this injection of federal authority into matters of state jurisdiction, particularly since the price regulation act specifically eliminated utility rates from OPA's sphere.

Some people see in this another round in the battle for states' rights, but bigger than that is the scuttling of proven regulation. The number of instances in which utilities have been granted rate increases is very small. State commissions have been very hard to convince that relief was necessary. These commissions, however, are familiar with the properties and with utility operations, and for that reason their judgment should be respected.

OPA has to respect the War Labor Board's decisions and should respect decisions of other regulatory bodies.

Sympathetic Rationing May Not Be Popular

DIMOUT of street lighting and blackout of all other forms of outdoor lighting are to be put in force next week in Ontario and Quebec because of a power shortage in the two provinces. Voluntary rationing is asked of residential customers and before the end of the year curtailment of non-essential uses is expected. Nothing, however, is stated in the release regarding reduction of exports to the United States, although it is understood that this has been suggested, particularly in connection with certain war production on Canadian account.

The Canadian power systems, like those in this country, have done a magnificent job in making power available for war work. They may have regrets that they do not have more resources to throw into the battle, but they can have no feelings of remorse.

Because of the reliance of the average home in this Canadian area on electricity for so many of the ordinary daily wants it is not going to be easy to secure a larger saving from rationing of this use. The larger savings will have to come from blackout of lighting and less essential uses, with perhaps some reduction of industrial load for a short time on the peak.

We hope, however, that this need for rationing can be localized and that there will not be a sympathetic blackout rationing on this side of the border. Limitations of use of one thing and another are being asked of civilians because of necessity. We should be careful not to impose any more than we have to.

The people in this country are proud to have Canada as a neighbor and ally. We do not need to impress this feeling further by sympathetic rationing.

Earmarking Deferred Maintenance for Post-War

THE SUGGESTION was recently made that utilities be permitted to charge deferred maintenance into current operating costs with the reserve so set up to be invested in war bonds earmarked for expenditure after the war. This is somewhat different from the proposed but turned down post-war return of part of taxes. In this instance it is a currently caused or currently existing situation that calls for the maintenance expenditure; by deferring it a year or two or three no great harm is done and employment is assured. Of course, not all maintenance would be deferred, only that which is not absolutely necessary now or for which materials are not available.

It looked like a good idea until viewed from the angle of regulation, when all sorts of objections arose. The principal one, of course, was the disinclination to recognize as an expense money which had not been spent. There is also the objection to carrying the responsibility for enforcing the expenditure of such earmarked funds at some future time.

However, it is suggested that there is no definite line of demarkation between maintenance and depreciation. Depreciation accounting, it is held by some regulatory authorities, could take care of much that is now charged as maintenance by subdividing the capital account into smaller items of property. There is provision for that in the FPC standard accounting system which has been adopted by most state utility commissions.

There is also the suggestion made last fall by FPC Commissioner Basil Manly before the Association of Railroad and Utilities Commissioners that during this period of greater revenues companies set aside larger amounts for depreciation. He had in mind not only the opportunity to build up depreciation reserves that might be low but also to provide a cushion against the time when reduced revenues might make adequate provisions for depreciation a difficult burden.

It would seem, therefore, that the accounting machinery is available to accomplish the suggestion for post-war employment through deferred maintenance without the inflexibility of earmarking as to time and amount. The ICC, on the other hand, has approved the deferred maintenance plan for the railroads so that there is some

sound regulatory precedent for the program suggested.

Nevertheless, it would seem that the tax complications attendant upon a proposed spending to be allowed as a current tax deduction might cause many a bad headache in the post-war period, none of which is involved in the depreciation method.

Where war loads cause heavy overloading many elements of property are being used up faster today than normally. Adequate provision must be made, therefore, if integrity of investment is to be preserved.

A Difference of 8½ Percent

IN A BRIEF in the Hartford Electric Light case the Federal Power Commission stated that as of June 30, 1940, there was included in the book figures of 4¾ billions of 211 companies the sum of 405 millions in excess of original cost. That is the difference between book figure and historical cost—8½ percent. Is this the evil write-up and inflation of value that makes rates so high—how much higher?

Last year the gross revenue from energy sales was $2,670,450,000. An 8½ percent saving on that would be 227 millions. This is a large sum in the aggregate, but in the case of the individual residential customer with an average bill last year of $36.86 the saving of an 8½ percent reduction would have amounted to 31 cents—between 2 and 3 cents a month. Is this the horrible overcharge that the utilities have perpetrated by their fair value concept as against the prudent investment theory?

If this were the only difference the utilities would be well advised to effect a compromise and be done with the expense of hearings and the constant publicity implying fraud. But this is only the beginning. What is acknowledged as historic cost is not necessarily the amount that will be permitted as prudent investment.

Death in the Dimout

SIX MONTHS of dimout has resulted in an increase in night-driving fatalities in the Borough of Manhattan, New York City, of 107 percent. Fifty-eight people were killed there in night-driving accidents from the first of February through July, 1941. During the similar six months this year the number of fatalities jumped to 120.

Nor is that the whole story. During the same period the day-driving fatalities were less by more than a third, due to reduced use of automobiles. In other words, the fatalities in terms of amount of driving were trebled by the reduced street lighting—the dimout.

These figures, which were compiled from the official records of the state motor vehicle department, are the first to be available covering the reduced lighting period. While the Army dimout rules did not come out until late in March and became progressively stiffer as tests were made, it would not be surprising if the entire Atlantic Coast experience were equally as bad or even worse. Can this loss in life and property be justified?

Furthermore, how much does street lighting, other than that actually facing the ocean, contribute to sky glow?

The Pacific Coast people appear to have recognized that adequate safeguards could be given to shipping without endangering the lives of citizens on the streets after dark. Perhaps our East Coast cities that seemed to welcome dimouts as a means for saving on street-lighting bills are losing money several times faster than the saving in light bills.

At any event we urge the industry to seek the cooperation of the Army in making tests to determine the facts. Nobody wants street lighting or anything else that is going to be the cause of loss of life and ships at sea. It is stupid, however, to increase the loss of civilian life needlessly. Let's find out how much street lighting contributes to sky glow.

It Takes Nice Doing

MUCH of the skill of the surgeon rests on his confidence that he can slice very close to an artery, vein or muscle without hazarding the patient or crippling him for life. About the same task confronts the utility engineer today. Circumstances are driving some operations on the utility system similarly close to "death's door" for the equipment—unless the engineer knows how close he can encroach and still "pull the patient through." If he doesn't know all the niceties of inbuilt margins of capacity, hotspot likelihoods, how much insulation will stand without dangerous shortening of life, he'd better brush up on it. Fortunately some equipments carry their own safeguards against permanent harm from overloading.

Engineers who have been engaged in routine planning and design are finding less occasion to hold to orthodox long-range procedures and more occasion to move fast, move expediently, move unconventionally, move more economically if possible, but, in any event, more courageously. It takes courage to sacrifice habitual caution and certainty; it takes sound knowledge to do so confidently.

That does not mean that all notions of economic design have to be shelved for the sake of expediency. On the contrary, it takes the highest degree of competency to do a better job quicker. It takes ingenuity to accomplish the job with equipment that would not be used in normal times. It takes engineering solidity to get better results with second-scale alternatives and substitutes. It takes real technical proficiency to coordinate the firm principles and programs of the recent past with the flexibility and adaptability demanded by the present. It takes smart judgment nowadays to add a plant-to-customer kilowatt at $125 where it used to cost $500 when comprehensive expansion plans were being executed without today's restraints and obstacles. That has been done on one property and it can be emulated on others.

All this is a challenge and an opportunity for the engineers. It is a chance to be patriotic, to do more with less, do it quickly, do it safely, do it smoothly, do it reasonably durably, do it by utilizing every ounce of capacity in the equipment available or obtainable.

Washington Comment

GEORGE E. DOYING, Jr., Washington Correspondent

Further Cuts in Maintenance Inventory

THE UTILITY priority order P-46 is being revised for the fourth quarter of the year and operating companies should expect a further tightening up in allowable maintenance and repair operations and inventory limits after October 1.

From a practical standpoint, the forthcoming slash in the P-46 quotas (Section F) will not slice deeply enough to affect most companies inasmuch as there is today considerable slack between what the order allows and what collateral wartime restrictions actually permit utilities to carry out.

Slack in all Control Groups

For instance, correlated PD-194 reports from utilities operating more than one-half the nation's generating capacity show use of less than 40 percent as much wire and cable in the first half of 1942 as during the comparable base period in 1940. The slack exists, although not nearly to the same degree, in all the control groups of the PD-194 form.

Revision of P-46, however, is likely to establish for the industry's wartime operations one or both of two basic principles which WPB seeks to effectuate in its renewed efforts to harness output of munitions and essentials directly with the supply and flow of raw materials.

To work, this scheduling of output contemplates constant manipulation of the distribution of all basic materials, with WPB operating the strings. The manipulation is applied not only to the amounts of the materials but to their use within the over-all allocation.

Thus, any base for establishing allowances of raw materials which is calculated from pre-war operations—such as the 1940 base now in P-46—usurps WPB's ability to cut the suit to fit the cloth; it permits use of materials in quantities which may have no relationship to the changing production schedule or to the adequacy of materials.

Fixed Base

For manufacturing industries, under scheduled output there is no fixed base. Determination of the quantity of materials to be made available for different products is made by WPB and individual applicants under the Production Requirements Plan report their previous quarter's operations only to provide a check on the reasonableness of their current requests and a guide to their proportionate allotment from the stockpile earmarked for their product.

Abandonment of a fixed base isn't so essential to meshing P-46 with the scheduled output program as in the case of a manufacturing industry. Where the call for materials is almost exclusively for maintenance of continuous and essential operations, there is a minimum of leeway in the determination of the allowance. But it is considered important to take up any slack resulting from such factors as the virtual elimination of new extensions, and the P-46 base may be altered accordingly.

Control Flexibility

More directly at issue in gearing P-46 into the scheduled output program is control over the use of allocated materials, through manipulation of the various control groups. Up to now, the allowance for all the PD-194 control groups except generating station materials (which are tied to output) has been 100 percent of the 1940 withdrawals on a dollar value basis. Nothing compels keeping all substation transmission and distribution maintenance on the same plane; in fact, the shortage of materials might easily make it advisable to insure that whatever is allocated be used to keep some operations in sound repair even at the expense of others.

The efficient exercise of such control doubtless would require breaking up the present five control groups into smaller units. Distribution transformers, for instance, could be removed from the Other Transmission and Distribution Materials category to one setting up direct control over this type of maintenance.

It is not expected that revision of P-46 will reach that far in the fourth quarter. As a step in that direction, however, it appears likely that the dollar-value ratios of the five established control groups will be altered by varying amounts—with distribution equipment naturally taking the greatest cut.

Stock Situation

What about inventory? The forthcoming P-46 revision almost certainly will reduce the present 1940 inventory base, perhaps drastically. Utility inventory has long been considered in WPB as a somewhat special problem from most industrial inventory. It still is so considered. Utilities have large stocks of material on hand which were purchased for extensions and construction projects which the war has stopped. They also carry in inventory considerable specialty equipment and some which is obsolete. The bulk of these materials cannot be used, at least quickly, for maintenance, nor for wartime construction—either by the utility holding them or by others. Yet it is a stockpile too valuable for scrap and most of it will be usable some place before the war ends.

On the other hand, the utilities included in the PD-194 report tabulation mentioned above show inventories of most materials which, in relation to second quarter use, would last from a year to five years—three years for all types of wire and cable combined—at a time when WPB's scheduled output program is attempting to pare inventories to around 45 to 60 days. Yet, in practically every category, these utilities are within the P-46 limit today.

NEWS OF THE WEEK

Power Rationing Goes Into Effect in Canada

Curtailment of non-essential uses expected to result in 140,000 hp. saving, voluntary 20 percent cut in domestic use another 100,000 hp. to help meet 400,000-hp. shortage in Ontario and Quebec

Power rationing became an actuality in Canada last week.

In an order which becomes effective September 20 sharp curtailment of non-essential uses of electricity in the power shortage areas of Ontario and Quebec was ordered September 12 by the Hon. C. D. Howe, Munitions Minister. Advertising signs and show windows will be blacked out, street lighting curtailed, highway lighting prohibited and outdoor ice rinks required to shut off their flood lights at 10 p.m. Residents of the affected areas, the Minister said, would be expected to give up voluntarily the use of 100,000 hp., which meant a cut of approximately 20 percent in the average domestic electric bill.

"Every power plant in southern Ontario and Quebec is working at full capacity," Mr. Howe said in announcing the restrictions. "Despite this we face a shortage of some 400,000 hp. in the two provinces and further expansion of our war industries will make the situation that much worse."

The restrictive order is expected to result in a saving of about 140,000 hp. If public cooperation adds another 100,000 hp., the remainder of the deficit, 160,000 hp., will be found by cutting off non-essential users wherever and whenever necessary, the Minister's statement said.

Ontario Emergency

Action by the government followed a power shortage which lopped off 100,000 hp. for a three-hour period from war plants in southern Ontario September 8 and 9. This marked the first time since the outbreak of the war that power requirements for industrial purposes have not been obtainable for longer than a period of a few minutes. Following the shortage, an emergency order was issued by the Ontario Hydro Commission, through its chairman and chief engineer, Dr. T. H. Hogg, asking all municipalities to cooperate in cutting down the load for non-essential purposes. Dr. Hogg warned that if voluntary cooperation were not forthcoming restrictive measures might have to be applied, including provision for penalties. The emergency order was issued as a stop-gap to the Power Controller's order cutting non-essential uses which comes into effect September 20.

UP FLAGS FOR DAYTON—Enlisted men from Patterson Field, near Dayton, Ohio, post the colors and the Treasury Department's "Minute Man" flag at the offices of the Dayton Power & Light Co. More than 98 percent of the company employees are buying war bonds out of their pay checks — sufficient to buy a four-motor bomber a year. Over 150 employees of the company are in the armed services

The Ontario Hydro Commission will have to reduce its load by some 200,000 hp. during the winter months apart from the anticipated 100,000 hp. reduction which is expected from the Dominion restrictions later in the month, Dr. Hogg emphasized. Since the war started approximately 700,000 hp. has been added to the commission's resources, but all of it has been absorbed by rapidly expanding war industries. A reduction of the load in the southern Ontario area of 300,000 hp. represents a cut of approximately 15.5 percent of the estimated capacity of the producing units in that area, as of December 1 next. By the end of the year primary demand in the area will reach 2,197,000 hp., Hydro engineers estimate, while estimated capacity as of December 1 will be only 1,945,000 hp.

Paper Power Use Cut

Meantime the pulp and paper administration of the Wartime Prices and Trade Board met recently to discuss power rationing for Canada's $400,000,000 newsprint industry, which supplies nearly three-quarters of the United States supplies of newsprint. Under the leadership of R. L. Weldon, newly appointed newsprint administrator, plans for the allocation of newsprint production to paper mills in areas less pinched for manpower and electricity were formulated. The Ontario Paper Co. at Thorold, Ont., which has been operating at partial capacity under the threat of complete curtailment of its power, was allotted 10,500 hp., "which, combined with its own, should permit operation of at least two

machines" of the five with which the plant is equipped, according to Labor Minister Humphrey Mitchell. The power rationing order for the plant goes into effect Oct. 1. The Thorold mill is on the Welland Canal in the Niagara peninsula area of Ontario, where the power shortage is most acute because of the electrometallurgical and electrochemical plants nearby, both in Canada and the United States.

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Canada Curtails New Extensions

Drastic curtailment of use of copper or other non-ferrous metals for the extension of public utility service in Canada was announced recently by the Hon. C. D. Howe, Minister of Munitions and Supply. The war conservation move was embodied in a new order, issued by Metals Controller George Bateman, and its provisions are as follows:

1. It prohibits any new installation of electric, gas, water or telephone service in summer cottages and other seasonal residences, (2) it prohibits new installations of electric advertising and display signs, (3) it prohibits new lighting for city streets and highways, (4) it rules out all public utility service extensions to refreshment booths, carnivals, seasonal places of business and other civilian places of entertainment, (5) it prohibits, except by permit, any new street railway lines or extensions to existing lines, and (6) it prevents any home owner whose dwelling is more than 250 feet from water and gas mains or power and telephone lines from obtaining electricity, gas or other public service connections without a permit.

Metals necessary for maintenance and repair, for emergency requirements of the armed forces and for certain essential civilian and military direct connections from lines, leads and mains are exempted, provided that installation costs do not exceed $500 and involve no more than 20 pounds of non-ferrous metals.

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Raise Ratings for Line Extensions

Higher ratings with which to obtain copper and steel products for war extensions in certain cases are made available to utilities by Amendment 4 to Order P-46 issued this week.

The amendment provides that where extensions are being made under section E-2 of P-46 to serve war projects with two or more ratings of A-5 or higher, utilities may apply the highest rating held by the war project for copper and steel items to their own purchase orders for copper and steel material. Previously, utilities could get only the lowest of the war project ratings which often proved insufficient for obtaining copper and steel.

"M" ADDED TO "E"—A. G. Pratt, president of Babcock & Wilcox Co., manufacturer of power boilers and accessory equipment for the Navy and Maritime Commission, accepts the "M" award of the latter, in behalf of the Barberton Works of the company. Award was made by Rear Admiral Emory S. Land, chairman of U. S. Maritime Commission. The "M" burgee now flies alongside the Navy "E" awarded the company on May 11

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Lyons Succeeds Falck at WPB

William A. Lyons, comptroller of NY-PA-NJ Utilities Co., has been appointed chief of the WPB power division's allocations section which administer's the electric curtailment Order L-94 and the various gas utility curtailment orders. Mr. Lyons succeeds Edward Falck, head of this section since its creation, who has transferred from the power division to be an assistant to the division's former chief, J. A. Krug, now WPB director general of operations in charge of priorities.

A graduate of New York and Fordham Universities, Mr. Lyons has been with the Associated Gas & Electric System in various executive capacities for 13 years, the last four in the NY-PA-NJ company position.

No change in the policies of administration of L-94 is in prospect.

NEWS BRIEFS

A QUANTITY OF ELECTRICAL APPLIANCES and at least 4,000 feet of conduit cable, which comes under priority ratings, were recovered and two Fort Knox, Ky., civilian electricians arrested recently when cruising police became suspicious of a quantity of appliances they glimpsed through an open garage door. Charges of vagrancy and banding to commit a felony were placed against two men found on the premises who claimed that the equipment was to be used for house wiring.

PACIFIC GAS & ELECTRIC rural customers will be billed for service every two months after October 1, instead of the customary monthly interval, the company announced recently.

TVA REPORTED RECENTLY that during the fiscal year ended June 30 it had achieved the best safety record of its nine years of operations, despite the fact that it is engaged in the largest and fastest construction schedule in its history. The authority's frequency rate of accidents was 14.1, a reduction of 10 percent during the year; its severity rate was 1.95, a 12 percent reduction.

THE 165-FT. STEEL TOWERS, 29 in number, each surmounted by moon-shaded mercury-vapor lights, which comprise the principal municipal lighting system of Austin, Tex., came unscathed through the recent tropical storm which swept into the interior from the Gulf of Mexico, according to acting city manager Walter Seaholm. The towers and lights have been in constant service for 47 years. Originally there were 31 of the towers. In 1924 a tornado destroyed one of the towers and, in the big storm of 1929, a tower fell when a guy wire broke.

THE CONDEMNATION SUIT in the Lewis County (Wash. PUD against the Washington Gas & Electric Co., scheduled for Tacoma federal court on November 16, has been postponed until December 7 because farmers in eastern Washington want to get their crops in and not be required to serve on a jury at this time. Calls for jurors for similar cases have resulted in nearly every prospect begging off because of the harvest.

THE TOWN OF EDENTON, N. C., enjoying some of the lushest prosperity in its 200-year history, decided recently to give the taxpayers a bonus. Electric consumers were given free all the power they used during the month of June.

WITH THE TOURIST SEASON virtually at an end, the illumination of the American Falls at Niagara Falls, N. Y., was discontinued recently.

OPA "Veto" Power on Rate Increases Sought

Senator Norris introduces amendment to the Price Control Act requiring federal and state regulatory commissions obtain Henderson's approval on proposed rate increases

Jogged into action by a Washington, D. C., gas rate increase case, Senator George Norris, Nebraska Independent, has introduced legislation giving the Office of Price Administration "veto" power over all utility rate increases during the war.

Amendment to Price Control

Norris' bill is an amendment to the Price Control Act which now specifically excludes utility rates from OPA's jurisdiction because they already are under state regulation. The amendment would require that concurrence of the Price Administrator be obtained by any state or federal regulatory agency before granting a rate increase. The measure is before the Senate finance committee awaiting hearings, which will not be started at least until the tax bill is passed.

The Nebraska Senator introduced his bill after hearings before the District of Columbia Public Utilities Commission indicated the Washington Gas Light Co. might be granted a $350,000 rate increase in accordance with the formula of its sliding scale agreement—first such increase ever resulting from the Washington rate formula now applied to both gas and electric rates.

OPA Position

Before acting, Norris wrote to Price Boss Leon Henderson on the subject. In reply Henderson re-enunciated OPA's position that utilities should not pass along in increased rates war taxes (ELECTRICAL WORLD, July 25, 1942, page 74), and added:

". . . we are proceeding in the belief that when Congress exempted these rates from our jurisdiction, it was implied that these commissions would recognize that the dominant principle governing the fixing of prices in wartime would be the government's program to stabilize commodity prices and the cost of living and that utility and rate principles must be reexamined in the light of the government's economic program . . . Their recognition of this obligation will be an important step in the success of the government's program to prevent further increase in the cost of living.

"Therefore, while I hope there will be no need for additional legislation in this field, serious consideration must be given to the practice in Canada, where the consent of the price board . . . as well as that of the existing regulatory authorities is a prerequisite to utility, rate increases."

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Seaway Project off Roosevelt Hints

Commenting at a press conference on a speech by Leland Olds, chairman of the Federal Power Commission, advocating immediate construction of the St. Lawrence waterway and power project, President Roosevelt indicated last week that all plans for constructing the $285,000,000 project will, in all likelihood, have to be abandoned, because of the shortage of strategic materials, for the duration of the war.

Mr. Roosevelt made it clear that the Olds speech, made from a boatdeck at the Westport, N. Y., dock to the Champlain Valley Council, had not received any "read and approved" note from the President. He expressed the view that Congress was in fault for its long delay in authorizing the project, explaining that he had asked approval of the plan several times during the last four years. If it had been started when he asked for it a year and half ago, the President said, it would now be half completed. But that, he said, is water over the dam now and the question resolved itself into one of whether the strategic materials needed should be used at this time.

Mr. Olds said the project could be completed in three years, a year less time than estimated by President Roosevelt in recommending the project to Congress a year ago, and make available 2,200,000 kw. of power for war production as well as provide an inland waterway to states having 16 billion dollars worth of war contracts.

The FPC chairman's talk marked the first public effort to revive the St. Lawrence as a war project in several months. Legislation authorizing the project has been blocked in the House rules committee since last fall. Recently the War Production Board outlined an over-all power expansion program to provide for war needs as they can now be foreseen which does not contemplate construction of St. Lawrence.

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SEC Postpones Hearing

At the request of the company, the SEC has postponed from October 1 to October 15 its scheduled hearings on corporate simplification proceedings, directed against the Niagara Hudson Power Corp. and its subsidiaries, under

FIRST BOND BUYERS—At Chicago's new Treasury Center in Commonwealth Edison's main store were C. Y. Freeman, chairman of the board (left) and Edward J. Doyle, president (center). Nine thousand feet of space for the new bond sales base was donated to the U. S. Treasury Department by the Chicago utility

FOSTER WHEELER HONORED—The second award of a Navy "E" to Foster Wheeler Corp. was made to the Dansville, N. Y., shops of the company recently. First award went to the Carteret, N. J., shops, May 12. Above, left to right: Floyd Shepard, president of the local employees' union; Rear Admiral Clark H. Woodward, who made the presentation, and David McCulloch, executive vice-president of Foster Wheeler, who accepted the pennant in behalf of the employees

the "death sentence" clause of the Holding Company Act (ELECTRICAL WORLD, September 5, page 73). At the same time the commission extended from September 15 to October 1 the period in which the companies are required to file answers to the allegations.

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FPC to Enforce Niagara Falls Order

The Federal Power Commission announced recently that it had dissolved its stay order of June 9 requiring the Niagara Falls Power Co. to charge to earned surplus $15,537,943 in "write-ups" in its accounts and is ordering the utility to comply with the order within 60 days (ELECTRICAL WORLD, June 27, page 62; July 4, page 8; August 22, page 70). The original order was issued on June 6 and stayed on June 9 to give the company an opportunity to "show cause" why the order should not become effective.

The power company's contention that compliance with the order would affect its credit and impair the distribution of its earnings was set aside by the commission, which charged that the utility had failed to submit any alternative accounting treatment for disposition of the disallowed amounts.

"It is probably true," the commission's opinion said, "that any deficit created in the licensee's earned surplus by charging $15,537,943 to that account will preclude the declaration of dividends until the deficit is wiped out. However, the licensee could have proposed the creation of a capital surplus for absorption of such deficit which would substantially eliminate this objection. . . . Licensee, in its response, makes the novel request that we revise our accounting requirements to permit it to retain the disallowed amounts in its fixed accounts 'as valid assets for all corporate purposes and for all license purposes.'"

The company's contention that the FPC order conflicted with the jurisdiction of the Public Service Commission and the SEC was dismissed by the FPC as "clearly erroneous."

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Buffalo & Niagara Omits Dividends

Directors of the Buffalo, Niagara & Eastern Power Corp., at a meeting held last week, took no action with respect to dividends on either the $5 preferred or $1.60 preferred stock of the company. Omission of the dividend on the preferred stock was the first such action taken by the company since the issue was offered in 1928. Total annual dividends on the two preferred stocks amount to more than $5,000,000, total annual payments on the first preferred amounting to $1,750,000 and on the $1.60 preferred $3,354,741.

In a letter to stockholders, the company laid the dividend omission to actions of the Securities and Exchange Commission and the Federal Power Commission. The SEC on August 28 invoked the "death sentence" provisions of the Holding Company Act against Niagara Hudson Power Co. and six subsidiaries, including the Buffalo, Niagara & Eastern Power Corp. (ELECTRICAL WORLD, September 5, page 73). Hearing has been set for October 15.

The Federal Power Commission, in a June order, determined the "actual legitimate original cost" of the Niagara Falls Power Co. as of the date of the license was $15,787,688, less than the book cost of such fixed capital on March 2, 1921. Of this amount, the company was directed to charge $15,537,943 to earned surplus and transfer the balance to other accounts. The company intends to review the order in the courts, the letter said, and pending conclusion of the court review, it must be assumed that Niagara Falls Power Co. will not pay dividends on its stock.

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Portable Fans Curbed by WPB

Portable electric fans in the hands of manufacturers have been placed under allocation by WPB to conserve the supply for war and essential civilian uses. Stocks in the hands of dealers and retail distributors are not affected.

The order, L-176, stipulates that no fan in manufacturers' stocks may be transferred without specific WPB approval, obtained by application on Form PD-556. Production of fans is further restricted to the 5,000-odd units being assembled under Treasury Department Procurement Division "victory model" specifications, under Navy and Maritime Commission specifications for shipboard use, and as a result of successful appeals from the provisions of the "stop" order, M-9-c. Except for the Treasury units, other newly fabricated fans may be transferred only after authorization granted on PD-556 application.

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SEC Reconvenes Hearings on U.G.I.

The SEC issued an order recently reconvening hearings, on September 29, in proceedings instituted by the commission against the United Gas Improvement Co. and its subsidiaries, under the geographical integration section of the Holding Company Act, requiring the company to divest itself of its direct and indirect interests in the Public Service Corp. of New Jersey. The original order was issued April 9, 1941.

The commission's latest order for a hearing follows a decision on August

12 by the third U. S. Circuit Court of Appeals upholding the SEC in its contention that Public Service Corp. was a subsidiary of U.G.I. and its parent, United Corp. (ELECTRICAL WORLD, August 22, page 72). The commission set September 21 as closing date for receiving applications for persons wishing to intervene in the proceeding.

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Water Storage Continues Good

Continued improvement in water storage and ground-water levels and elimination of all areas of deficient stream flow in eastern and southeastern United States were noted in the August report on water conditions throughout the United States and Southern Canada, released by the U. S. Geological Survey and the Dominion Water and Power Bureau.

The report's summary showed beneficial effects of reserve water storage in the heavy power-producing and industrial areas of Quebec and Ontario, where deficiencies in stream flow have persisted for two months. In Ontario, north and northeast of Lake Huron and in the extreme western part of Quebec, however, storage reserves are now considerably below normal and abundant precipitation will be needed, the report indicated, during the autumn months in that area if the deficiencies are to be relieved.

Some record-breaking floods were noted throughout the central West in northern Michigan, Iowa and eastern Nebraska, and in northern New Jersey, western New York and northeastern Virginia. In the Pacific Northwest and Rocky Mountain areas there was below-normal natural stream flow, but storage for irrigation and power were well maintained. In California continuation of above-normal stream flow was reported and excellent storage in reservoirs and in the ground.

Generally, the water outlook was reported as "good to excellent."

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Extend Meter Check

The Alabama Public Service Commission has authorized gas and electric companies of the state to test meters for accuracy every eight instead of five years as heretofore. This was done, the commission said, to conserve material and manpower for the war effort.

The extension as to gas meters applies to those having a capacity of 400 cu.ft. an hour or less; for electric meters, to single-phase, watt-hour meters of 50 amp. or less.

Ban Enlistment of Men in Essential Jobs

Army-Navy joint ruling acts to bar loss of civilians important to industry — Utility employees in essential categories must obtain direct release from their employers

The Army and Navy, in a joint action, this week placed a ban on voluntary enlistment of civilians whose leaving would impair efficient functioning of essential industries, including utilities.

Civilians in key executive or technical positions must obtain written release from their employers before they will be accepted for enlistment or given a commission. Civilians in essential industries whose jobs are outside the executive and technical categories must obtain a release from their Selective Service Board, if registered, and the employer may appeal from the board's decision in the same manner as in a draft case.

Utility Employees Affected

For practical purposes, utility employees whose jobs fall within the categories described as essential in Selective Service Occupational Bulletin No. 9 (ELECTRICAL WORLD, June 6, 1942, page 3) will normally be ones requiring direct release from employers; other utility employees the ones requiring release from the draft board.

In addition to the direct ban on enlistments which might cripple industry, the list of occupations covered by the Army-Navy policy is to be used as a guide to local draft boards in connection with problems of occupational deferment and by the U. S. Employment Service in determining priorities for referrals of workers to jobs.

The action of the services came in response to a growing number of complaints from industry that Army and Navy recruiting tactics were stripping the production front of many highly skilled workers. Other industries, in addition to utilities, which are covered by the new Army-Navy "anti-piracy" policy include all those previously listed by the War Manpower Commission or Selective Service as essential to or in support of the war effort.

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Senate Eases Utility Taxes

The Senate finance committee, completing work last week on the 1942 tax bill, adopted a proposal under which public utility companies, other than railroads, will be permitted to deduct preferred stock dividends from income for the purpose of computing surtax net income.

Action was taken at a prolonged session which saw a reduction in combined corporate normal and surtax rate cut to 40 percent from 45 percent, eased individual income rates in the middle brackets, and reduced the holding period for capital assets to six months.

"MINUTE MAN"—Sam Stites, manager Youngstown division of Ohio Edison, makes a talk after being presented with the "Minute Man" flag for 94 percent participation in war bond purchases by 859 employees in his division. Company was the first in Youngstown to win the honor

N.Y.C. Dimout Costs Edison $2,000,000

In the four-month period from May 1 to August 30 the occasional blackouts and the steady dimout in its operating territory cost Consolidated Edison Co. approximately 50,000,000 kw.-hr. of its electric load, representing almost $2,000,000 of revenue, the company announced recently. The practice blackouts, whether regional or city-wide, usually cut off about 50 percent of the normal night load in the area affected, but their infrequency caused them to account for a relatively small part of the lost load, the company said.

The dimout, on the other hand, causes a steady nightly loss of load. Compared with the output for corresponding weeks of last year, this loss for the hours from 8 p.m. to 5 a.m. has fluctuated in the four-month period from around 2 percent to nearly 4 percent of the weekly output. Variations in weather conditions were probably responsible for some part of the fluctuation, company officials said. For example, for the week ended June 28 the loss during those hours, compared with the previous year, amounted to 3.71 percent—740,000 kw.-hr. a night. The week ended July 19 showed a considerably smaller loss —426,000 kw.-hr. a night, or 2.1 percent compared with the corresponding week the year previous. In only two weeks of the four-month period was there a lower nightly loss of load, the week ended August 16, with 119,000 kw.-hr. nightly loss, 0.6 percent compared with the corresponding week of 1941, and the following week with 161,000 kw.hr. nightly loss, or 0.8 percent compared with the 1941 week. Those two weeks were hot and rainy, the weather causing people to stay indoors more than normally, and creating an unusual use of fans and air-conditioning equipment.

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WPB Salvage Manual for Electric Utilities

A "Salvage and Scrap Material Manual" has been prepared by the Utility Unit of the Industrial Salvage Section in the Conservation Division, WPB, for the information and use of utilities in their salvaging and scrap operations. It was prepared from procedures furnished by several utility companies and is submitted as a record of present practice.

The manual is a compilation of the information available at the time of issue and descriptions of other methods of salvaging materials and handling of scrap will be very gladly received.

Additional information on detailed practices may be obtained by writing to the Utility Coordinator, Industrial Salvage Section, Conservation Division, War Production Board, Washington, D. C.

The manual consists of three parts. The first section is an alphabetical listing of salvageable materials in the utilities with descriptions of rehabilitation procedures practiced by several different companies. Appendix A consists of photographs of apparatus used in various salvaging operations, and Appendix B is an assembly of scrap material specifications.

MEETINGS

Engineers Council for Professional Development—Annual meeting, Engineering Societies Building, 29 West 39th St., New York, N. Y., October 18. H. H. Henline, secretary, 29 West 39th St., New York, N. Y.

Previously Listed

Illuminating Engineering Society—Annual convention, Hotel Jefferson, St. Louis, Mo., September 21-22. Frank G. Horton, executive secretary, 51 Madison Ave., New York, N. Y.

International Association of Electrical Inspectors—Southwestern Section, Fresno, Calif., September 21-23, H. L. Gerber, secretary, Room 205, City Hall, San Francisco, Calif. Western Section, Book-Cadillac Hotel, Detroit, Mich., October 5-7, F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern Section, Taft Hotel, New Haven, Conn., October 12-14, F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern Section, John Marshall Hotel, Richmond, Va., October 19-21, C. M. Jones, secretary, 307 Trust Company of Georgia Bldg., Atlanta, Ga.

Association of Iron and Steel Engineers—Technical conference, William Penn Hotel, Pittsburgh, Pa., September 22-24. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Indiana Electric Association—Business meeting, Indiana War Memorial Bldg., Indianapolis, Ind., September 24-25. R. E. Bloosom, secretary, 1414 Circle Tower, Indianapolis, Ind.

Southeastern Electric Exchange—Engineering and Operating Section, fall conference, Henry Grady Hotel, Atlanta, Ga., September 24-25. John W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

International Municipal Signal Association—Annual meeting, Benjamin Franklin Hotel, Philadelphia, Pa., October 4-7. Irvin Schulsinger, secretary, 8 East 41st St., New York, N. Y.

Electrochemical Society — Fall meeting, Hotel Statler, Detroit, Mich., October 7-10. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York, N. Y.

Kansas Association of Municipal Utilities—Annual convention, Porter Hotel, Beloit, Kans., October 12-13. L. C. Angevine, secretary, City Hall, McPherson, Kans.

American Society of Mechanical Engineers—Fall meeting, Hotel Sagamore, Rochester, N. Y., October 12-14. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York N. Y.

American Welding Society—Annual meeting, Hotel Cleveland, Cleveland, Ohio, October 12-15, Miss M. M. Kelly, secretary, 29 West 39th St., New York, N. Y.

Edison Electric Institute—Electrical equipment committee, Gibson Hotel, Cincinnati, Ohio, October 19-20; transmission and distribution committee, Gibson Hotel, Cincinnati, Ohio, October 19-20. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

Pacific Coast Electrical Association—Business Development and Administrative Services Sections, Californian Hotel, Fresno, Calif., October 22-23.

National Electrical Manufacturers Association—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 26-30. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

National Safety Council—Annual congress, Sherman Hotel, Chicago, Ill., October 27-29. N. H. Dearborn, managing director, 20 N. Wacker Drive, Chicago, Ill.

National Association of Railroad and Utilities Commissioners—Annual convention, Baker Hotel, Dallas, Tex., November 10. Ben Smart, secretary, 7411-13 New Post Office Bldg., Washington, D. C.

Superior Cited by FPC on "Write-ups"

In an order issued September 14 the Federal Power Commission directed the Superior Water, Light & Power Co., Superior, Wis., to dispose of $337,676 carried on the company's books in electric plant accounts, and to file with the commission by October 1 reclassification and original cost studies with respect to an amount of $974,795 established in its "electric plant in service" account.

With respect to an amount of $1,000,000 for common stock issued by the company in 1889, of which $300,000 was charged to the electric plant accounts, the FPC charges that the entire $1,000,000 was issued by the promoters to themselves "without consideration." The $300,000 amount, therefore, classified by the company in its electric plant accounts constitutes a "write-up," the FPC said, and is not a part of the actual cost of the company's plant.

Specifically, the company was ordered to dispose of amounts aggregating $340,363 by charges to the earned surplus account, to dispose of $7,252 by a charge to the reserve for depreciation account and to dispose of a credit amount of $9,939 by transfer to the "contributions in aid of construction" account.

•

WPB Sponsors Lighting Talks

War Production Board, Chicago office, is currently sponsoring a series of four industrial lighting conferences which will be arranged and held by the Chicago Lighting Institute one day a week. The first was held on September 17. This is believed to be the first instance in which a regional WPB office has sponsored conferences to show war plant management how lighting can improve war production efficiency.

Subjects of the four scheduled conferences are as follows: September 17, "Protective Light and Sabotage"; September 24, "How to Get More Light From Present Equipment"; October 1, "Infra-Red Sources and Applications," and October 8, "Correcting Lighting Faults to Speed Production."

•

SEC Permits Midland To Dissolve Units

A voluntary plan of Midland United Corp. for dissolution of Traction Light & Power Co. and the Shirley Realty Co., both subsidiaries of Midland, has been approved by the SEC (ELECTRICAL WORLD, August 1, page 10).

Output Registers Seasonal Decline

The drop in output, seasonally associated with the first half of September, did not occur this year until the second week, when, for the week ended Sept. 12, the amount of electric energy distributed by the light and power industry was 3,570,919,000 kw.-hr., as compared to 3,672,921,000 kw.-hr. for the week ended Sept. 5. For the combined two weeks of Sept. 5 and Sept. 12 the percentage of increase over the corresponding period last year was 12.2 percent. The difference in Labor Day dating for the 1941 year made the two-week comparison more accurate, according to the Edison Electric Institute, source of the figures.

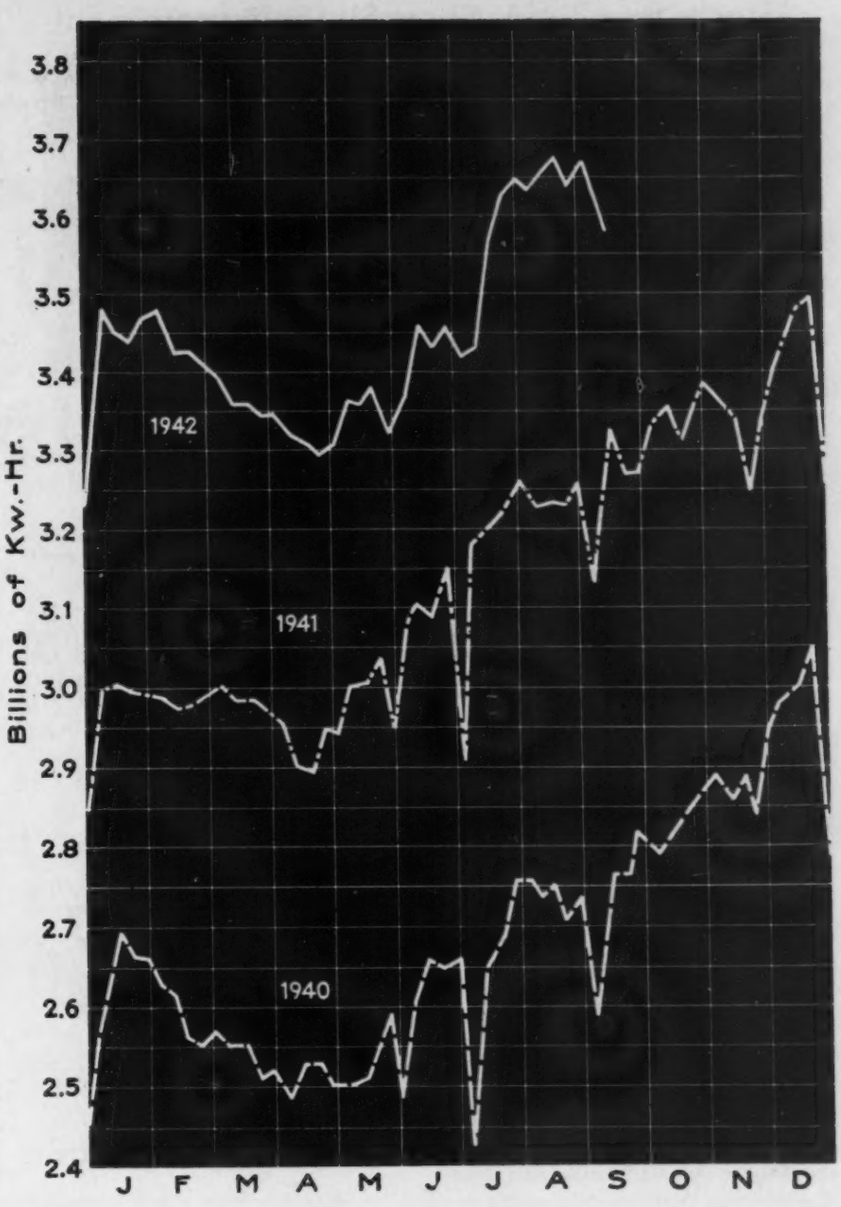
The Pacific Coast section, among the seven major geographic regions, maintained its high percentage of increase over last year's period with a 28 percent gain registered for the two-week period. Most of the other regions increased their percentage lead over the corresponding 1941 period.

Weekly Output, Millions Kw.-Hr.

1942		1941		1940	
Sept. 12	3,571	Sept. 13	3,322	Sept. 14	2,773
Aug. 29	3,640	Aug. 30	3,261	Aug. 31	2,736
Aug. 22	3,674	Aug. 23	3,231	Aug. 24	2,714
Aug. 15	3,655	Aug. 16	3,238	Aug. 17	2,746
Aug. 8	3,637	Aug. 9	3,323	Aug. 10	2,743
Aug. 1	3,649	Aug. 2	3,263	Aug. 3	2,767
July 25	3,626	July 26	3,220	July 27	2,761
July 18	3,565	July 19	3,199	July 20	2,681
July 11	3,429	July 12	3,178	July 13	2,657
July 4	3,424	July 5	2,904	July 6	2,425

Percent Change from Previous Year

	Week Ending		
	Sept. 5 & 12	Aug. 29	Aug. 22
New England	+ 7.9	+ 6.2	+ 6.2
Mid-Atlantic	+ 7.5	+ 5.9	+10.9
Central Industrial	+ 9.2	+ 8.8	+ 9.4
West Central	+10.9	+10.4	+ 8.7
Southern States	+12.9	+15.6	+19.0
Rocky Mountain	+12.1	+ 8.1	+ 8.9
Pacific Coast	+28.0	+29.8	+27.1
Total United States	+12.2	+11.6	+13.7



No Southwest Power Shortage Seen

Because of a combination of a lot of factors there are fewer prospects of a power shortage in the Southwest today than there were a year ago, according to C. S. Lynch, executive vice-president of the Arkansas Power & Light Co. and chairman of the operating committee of the Southwest power pool. Biggest reason advanced for the improved outlook, Mr. Lynch said, is that war plants have seldom exceeded 75 percent of their estimated power requirements.

"We had assumed that loads would grow from complementary causes as we had always experienced," Mr. Lynch said. "Taken over the entire area, the opposite has happened. There have been many business fatalities, for one reason or another, and all these are reflected in decreased loads. Shortages, and threats of shortages, in many items of ordinary use have made people thrifty, and this is evidenced in the amount of power they have required. Shortages of materials has curtailed many manufacturing plants, with corresponding curtailment of power use."

At a stockholders' meeting of the Arkansas Power & Light Co. C. H. Moses, president, re-emphasized that there was ample power available.

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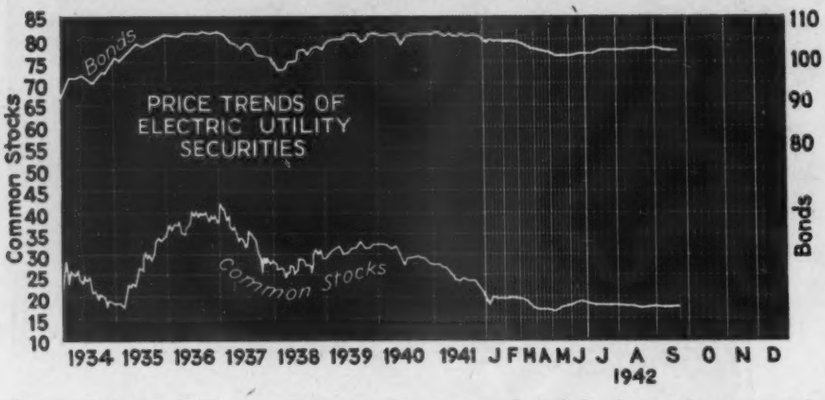
Jacksonville Survey Urges New Plant

A report on the electric facilities of the city of Jacksonville, Fla., recommending the erection of a new power plant adjacent to deep water, and constructed so as to use either coal or oil as fuel, was received recently by George A. Pierce, utilities commissioner, from Burns & Roe, Inc., New York engineering consultants, retained several months ago to survey the municipal plant and its distribution system.

The survey pointed out that the boiler capacity of the Talleyrand Avenue station is not sufficient to supply the demands of the present installed generating capacity and should be increased. It recommended that provisions should be made toward the installation of a new base load generating station, to be built as soon as possible. The present power station, the report said, cannot be depended upon for loads in excess of approximately 50,000 kw., based upon the possibility of the largest unit being out of service. The 1942 peak demand on the station will exceed this amount, the report said.

Stocks and Bonds Show Slight Improvement


PRICE TRENDS OF
ELECTRIC UTILITY
SECURITIES
Bonds
Common Stocks
Common Stocks
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
Bonds
1934 1935 1936 1937 1938 1939 1940 1941 J F M A M J J A S O N D
1942

Prices of electric light and power securities improved slightly during the past week. "Electrical World" stock index advanced to 17.8 from 17.7 the previous week; last year, 23.7. Bonds advanced to 103.1 from 103.0; last year, 105.6

Cities Service Unit Hit by SEC

The Securities and Exchange Commission have instituted proceedings against the Cities Service Power & Light Co. and six of its direct and indirect subsidiaries, under Section 11 (b) (2), the corporate simplification provisions of the Holding Company Act, and set October 6 for a hearing on the action. The most recent order involves the parent company, Cities Service Co., only to the extent of the securities it holds of Cities Service Power & Light.

The six subsidiaries of Cities Service Power & Light named in the order are the Federal Light & Traction Co., Central Arkansas Public Service Corp., Public Service Co. of Colorado, Ohio Public Service Co., Toledo Edison Co. and Empire District Electric Co. Some 49 other subsidiaries of Cities Service Power & Light Co. were not named in the order which gives the respondents until September 22 to file answer to the allegations.

Among the questions to be determined at the hearing are the following: (1) Whether the continued existence of Cities Service Power & Light unnecessarily complicates the Power & Light systems; (2) whether voting power is equitably distributed among security holders of the companies; (3) whether debenture and dividend payments should be prohibited to protect the company's financial integrity, and (4) whether the companies should be compelled to restate plant investments, surplus, capital and other accounts to eliminate write-ups.

Cities Service Power & Light had a capitalization of $134,234,944 as of December 31, 1941, 59.78 percent of which was owned by Cities Service Co., the parent. Consolidated assets of Power & Light as of the same date were $426,727,463. In its bill of particulars, the commission said that Power & Light, during the calendar years 1939 to 1941, inclusive, acquired 70 percent of its income from all sources from Public Service of Colorado, Ohio Public Service, Toledo Edison and Empire District Electric.

In May the SEC brought action under the same "death sentence" section of the Holding Company Act against Cities Service Co. and four other units, Empire Gas & Fuel Co. and its subsidiaries, Cities Service Gas Co., Cities Service Oil Co. (Del.) and Indian Territory Illuminating Oil Co.

•

$34,400,000 Utility Offering Is Made

An extensive financing program for Southwestern Public Service Co., involving public offering of $34,434,702 in securities, got under way September 15, with Dillon, Read & Co. heading a nationwide underwriting group offering the securities to the public. The issues comprise $20,000,000 of the company's first mortgage and collateral trust bonds, 4 percent series due 1972; $6,000,000 of 2½ and 3 percent serial notes, due 1943–1954; 60,000 shares of 6½ percent cumulative preferred stock and 185,000 shares of common stock.

The financing is designed to consummate a plan of integration and simplification whereby Southwestern Public Service will acquire the assets of Community Power & Light Co. and General Public Utilities, Inc., including the properties of Texas-New Mexico Utilities Co. and Gulf Public Service Co. The company will also acquire from Continental Gas & Electric Corp. the properties of the Panhandle Power & Light Co., Cimarron Utilities Co. and Guyman Gas Co. Following these acquisitions, the company will provide service directly to communities in Texas, New Mexico and Oklahoma and, through wholly-owned subsidiaries, will operate in Louisiana, Arkansas, Arizona and Florida.

Net proceeds from the sale of the securities will be applied to the redemption of outstanding obligations of Southwestern, Community and General, the retirement of subsidiary obligations and purchase of the securities of the Panhandle, Cimarron and Guyman companies under the integration plan.

•

Utility Asks SEC to Permit Merger

A plan to merge International Utilities Corp. with one of its major subholding company units, Dominion Gas & Electric Co., was proposed to the Securities and Exchange Commission last week during oral argument on liquidation of International as recommended by the commission. The merger, counsel explained, would enable International to meet the geographic integration requirements of the Holding Company Act, since the Dominion company operates only in Canada.

The merger plan, as outlined, would provide for the sale of the Rockland Gas Co., Inc., an operating company in New York State, which is the only utility subsidiary of International in the United States, all others being water properties. These companies, together with Rockland, are subsidiaries of General Water, Gas & Electric Co., the other major sub-holding company unit in the International system. Dominion, since it operates only in Canada, and General, operating only water companies under the proposed arrangement, would be exempted from the Holding Company Act.

Utility Reports

	Net Income 1942	1941
*American Gas & Electric and subs.	$12,089,901	$14,786,892
*Arkansas Power & Light.	1,972,000	1,329,412
*California Elec. Power and sub.	775,055	635,944
*Carolina Power a Light.	2,599,460	3,665,414
*Connecticut Lt. & Power	3,536,979	3,856,115
*Houston Lighting & Power	2,452,267	3,068,638
*Idaho Power	1,009,181	1,480,143
*Ohio Edison	3,408,983	3,859,138
*Pacific Power & Light...	730,504	864,320
*Pennsylvania Power	700,188	777,026
*Pennsylvania Power & Light	5,041,657	8,268,756
*Public Service of Indiana	2,938,635	2,889,790
*Southern Indiana Gas & Elec.	719,462	787,194
*Utah Power & Light and subs.	1,868,365	1,967,852

*Twelve months ended July 31.

HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

Meter Registers Average Voltage

Readings of average voltage over a given interval of time as well as of maximum and minimum average voltages in that period are given directly with a recently developed instrument which in certain applications may be used in place of a curve-drawing voltmeter. This device employs registers of the types used for watt-hours and demand; it is assembled in a portable case similar to standard watt-hour meters.

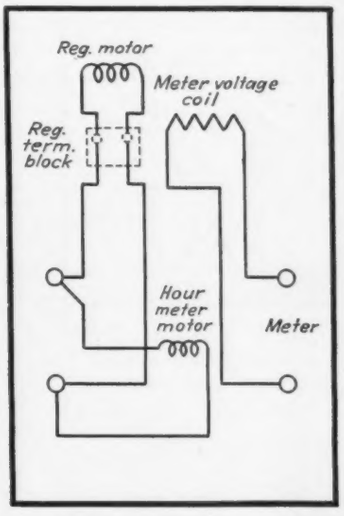
The metering element is an induction type disk driven by an electromagnet and retarded by permanent magnets, similar in structure to that of a watt-hour meter, except that the electromagnet (wound for voltage instead of watts) acts on the disk with a torque which is a function of the square of the voltage. The disk is calibrated to rotate at 30 r.p.m. with 120 volts, 60 cycles applied to the coil.

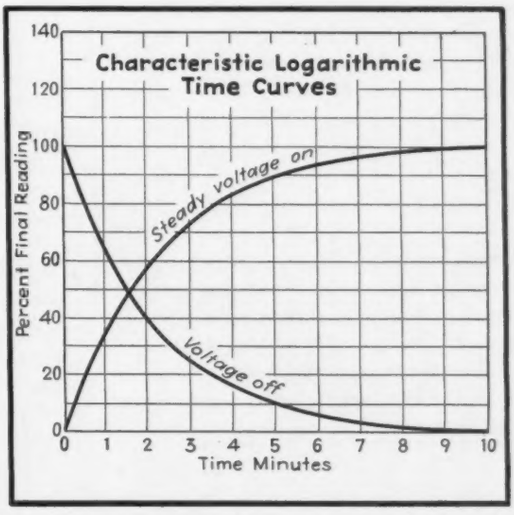
Thus the integrating register train reads in volts-squared hours. Dividing volts-squared hours by elapsed hours (as indicated on a separate dial of a "total hour meter") gives average volts-squared for the total period between readings. For all practical measurement purposes, this can be taken as average voltage. (A constant of 6,000 is used for obtaining the true volts-squared hours from these dials.)

The register mechanism is similar to that of a "logarithmic" demand register, mechanically lagged so that 90 percent of a constant applied voltage is recorded at the end of a five-minute "demand" period.

Maximum and minimum voltages during a definite time interval are indicated on the face of the instrument by two friction-restrained pointers operated by a pusher pin or rod the action of which is like that of the pointer of a very highly damped indicating voltmeter. This pusher pin travels from left to right through a circular slot in the dial, operating a minimum pointer across the left-hand scale and a maximum pointer across the right-hand scale. The pin is actuated by a differential gear, one side of which is driven forward by the action of the meter disk and the other side by a miniature synchronous timing motor.

At 100 percent rated voltage (120 volts) continued steadily this pin will come to the normal voltage position. With higher "average" voltage it will move to the right of the center and





AVERAGE VOLTAGE over a definite time interval is given by this instrument (left). Top dial registers volts-squared hours, indicates maximum and minimum voltages; bottom dial registers elapsed hours. Connections are made in the same way as to an ordinary voltmeter (center).

Two sets of terminals are provided—one for the synchronous timing motor, the other for the metering coils. The register, similar to "logarithmic" demand type, is mechanically lagged to register 90 percent of volts-squared hours in any five-minute period (right)

with lower average volts it will assume a position to the left of the center.

The meter is a development of the Westinghouse Electric & Manufacturing Company, meter division, Newark, N. J.

•

New Speed Indicator for Hydro Generators

By E. P. BRYANT
Division Superintendent of Generation, Los Angeles Bureau of Power and Light, Boulder Dam, Nev.

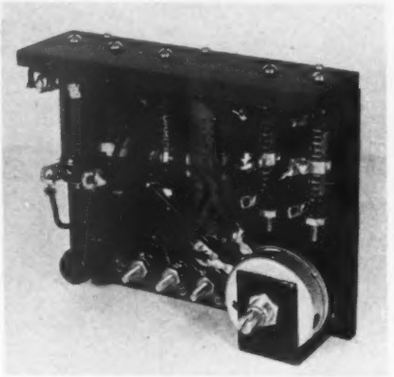
As an agent of the United States government, the Los Angeles Bureau of Power and Light operates and maintains a number of 82,500-kw. hydro-electric generating units in the Boulder power plant. Each of these machines was originally provided with a system of speed indication which consisted of a small gear-driven d.c. generator connected to two indicating voltmeters. These meters were located at important control centers and their scales were calibrated to show main shaft speed in revolutions per minute.

Because of the presence of oil vapor in and around these small d.c. generators, the commutators and brushes soon collected insulating films, which caused serious errors in the speed indication. Also, the rather fragile construction of these small machines made necessary special attention to the bearings, gears and mechanical parts. In spite of frequent maintenance these troubles still continued, so experiments were conducted to find a satisfactory system of speed indication which would not require the use of a small d.c. generator.

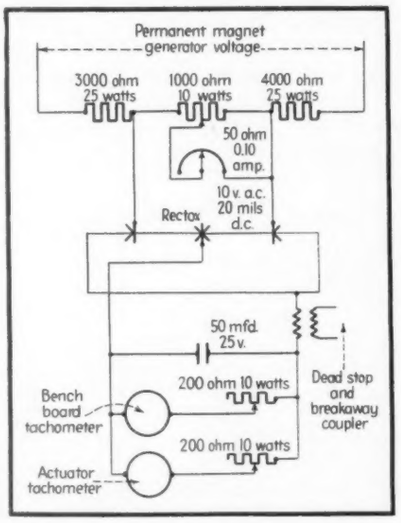
Fortunately each of the main units was provided with a small direct-connected a.c. generator which is used to supply the fly-ball motor in the speed governor. At the normal shaft speed of 180 r.p.m. these generators develop 160-volt, three-phase power at a frequency of 9 cycles. Because of their permanent field magnets and liberal stator design, it was found that the output voltage was directly proportional to shaft speed within the desired limits. With this as a basis it was then only necessary to develop a combination of resistors and rectifiers which would provide a low voltage d.c. potential that could be substituted for that previously obtained from the tachometer generator.

The resistor-rectifier combinations were made up in small compact units which could be installed in existing terminal cabinets with a minimum of external wiring. They were constructed of standard parts available in the open market and their cost was about $5 each. This compares favorably with a cost of $75 each for the tachometer generators they have replaced.

In the design of these resistor-rectifier units special effort was made to minimize the burden on the permanent-magnet generators and guard against the possibility of any internal or external failure which might interfere with the operation of the governor fly-ball motors. It was also necessary to provide an adjustment to take care of a slight variation in the output voltages of the different permanent magnet generators and possible future changes because of aging of the permanent magnets.



RESISTOR-RECTIFIER combination (cover removed), costing about $5, which replaces gear-driven d.c. generators as speed indicator on Boulder generators



PERMANENT magnet generator voltage-tachometer circuit (schematic) applied to Boulder generators for speed indication

Five of these speed indicating units are now in service and their performance has been excellent. Because of the lack of moving parts, they do not require any attention other than occasional inspection. Their accuracy is equal to that formerly obtained by the use of tachometer generators and their reliability is much greater. By their use a difficult operating problem has been solved and the over-all reliability of the important generating units with which they are used has been increased. It is planned to replace all tachometer generators at an early date. The resistor-rectifier unit is not patented but available to all.

•

Conductive Area of Steel Rails

By JOHN L. SKEEHAN
American Bridge Company, Ambridge, Pa.

An easily remembered method of determining the area of steel rails used for electrical conductors is to divide the weight of the rails in pounds per yard by 10, which will give the area of the rail in square inches within 2 percent on the high side.

The calculation is based on the weight of rolled steel being 489.6 lb. per cubic foot. Therefore, a 1-in. square weighs 3.4 lb. per foot or 10.2 lb. per yard. The actual area of the rail in square inches would, therefore, be:

$$\frac{W}{10.2} = 0.098\ W$$

where W = weight in pounds per yard of rail

Individual rails may vary as much as this 2 percent, the A.S.T.M. specifications allowing a variation of 0.5 percent on a whole order.

The area in millions of circular mils (which we will call $\overline{\text{M}}$ CM, the M with a line over it meaning 1,000,000 in Roman notation) of a steel rail, within 1/80 of 1 percent, will be:

$$\frac{W}{10.2 \times 0.7854} = \frac{W}{8.00108} \quad \text{say } \frac{X}{8}$$

This latter rating in $\overline{\text{M}}$ CM may be converted to copper wire equivalent

by introducing a factor K, the relation betwen the conductivity of copper and that of steel.

This factor, according to the Delta-Star Company catalog, may vary from 6 for soft steel conductors to 15 for hard steel rails. In the Delta-Star table of comparisons this factor is taken as approximately 12.5.

Therefore the equivalent copper wire in $\overline{M}$ CM will be:

$$\frac{W}{8\ K} = \frac{W}{8 \times 12.5} = \frac{W}{100}$$

Thus a 20-lb. hard steel rail will equal a copper wire of 0.2 of 1 $\overline{M}$ CM or 200,000 CM, equivalent to a No. 4/0 copper wire.

A soft steel conductor may have twice this capacity.

•

Salvaging Cable Insulation Rubber

Like other large corporations, the Timken Roller Bearing Company frequently accumulates sizable quantities of scrap electric cable. Until recently it has been general practice to burn the rubber and cloth insulation off these cables to salvage the copper.

Timken conservation men, seeking a method of salvaging the rubber in the cable insulation, experimented with a standard Buffalo bending roll machine. This consists of three smooth wheels, two of which are in tandem beneath a third wheel which is centered above them. Varying pressures are exerted upon the material to be bent by raising or lowering the upper wheel.

One lower wheel was removed and replaced by a notched gripper wheel. A sharp center-flanged wheel replaced the upper wheel. No change was made in the third wheel. This conversion proved extremely effective in removing the outer layer of braid insulation and the inner layer of fine rubber, which is so urgently needed at the present time. The gripper wheel feeds the cable between the flanged cutter wheel and the pressure wheel, slicing the cable open and peeling it simultaneously. The braid cover drops away from the rubber, leaving the rubber and the copper in salable condition without further attention.

Cable rubber salvaging is accomplished at the rate of about 6 ft. per minute. Cables ranging in size from $\frac{5}{8}$ to 2 in. are easily handled. This machine is regularly used in connection with the sheet metal department

BENDING MACHINE adapted to cable stripping

and is converted to salvage use in about three minutes by simply replacing the two regular wheels.

•

Propeller Pump Solves Water Problem

For the low head involved, the higher operating speed possible with a propeller type pump brought economies in investment and indirectly in operating cost that favored it over a more conventional but slower speed centrifugal pump for booster service in the condenser water supply system at Morrow station of the Consumers Power Company.

Water for the surface condensers at this station is taken from a pond which may vary rather widely in level in dry years. During normal pond level periods in the winter season, when circulating water is cold, flow through the condenser, under gravity head, is sufficient for full load. In summer low-water periods, however, static head from the dam may fall to about 12 ft. or less. To obtain the necessary flow for full load in summer under these conditions an additional pumping head of about 11 ft. is necessary in order to overcome condenser friction of 15 ft. and external (piping and valve) friction of 7.6 ft. At lighter loads, of course, a lower pumping head will supply the requisite flow.

For these conditions a vertical propeller type pump with a side inlet and bottom discharge was selected and installed so that water from the dam flowed downward through the pump, an arrangement that is counter to the conventional pump practice of forcing water upward.

A propeller type pump was selected over a centrifugal pump when study of characteristics showed that for the head required installed cost of a higher speed (385 r.p.m.) propeller pump would be less than the centrifugal which for this head required a maximum speed of 220 r.p.m. For the horsepower required the cost of the higher speed pump and motor was sufficiently lower than the slow speed to swing the decision. In addition, less space was required and a better layout was obtained.

Economies, Not Drawbacks

Usual objections to propeller type pumps did not weigh heavily in this instance. The characteristic high horsepower input required for propeller type pumps under the SND condition (discharge valve closed) did not prevail because the discharge of the pump will never be closed when the pump is operating. Cavitation was not a problem because of the 12-ft. minimum submergence. The required pumping head was low.

Since it was needful to economize on water even at high lake levels a variable-speed slip-ring motor was selected for the pump drive. In addition to making it possible to adjust pumping head to flow requirements, the variable-speed motor also permitted economies in operating cost, since power input to the pump varies as the cube of the motor speed. Below the lowest pump speed the motor is cut off the line and water allowed to flow through the pump under full static head. The propeller type pump used offered but little resistance to flow under this condition.

The pump used has a capacity of 52,000 g.p.m. at 11-ft. head and a speed of 385 r.p.m. Rated brake horsepower is 173 and efficiency 83 percent under design conditions. Motor used is rated 200 hp. and is speed adjustable from 70 percent to full rated speed.

PROBLEMS

1. BUS OIL SWITCH PROTECTION

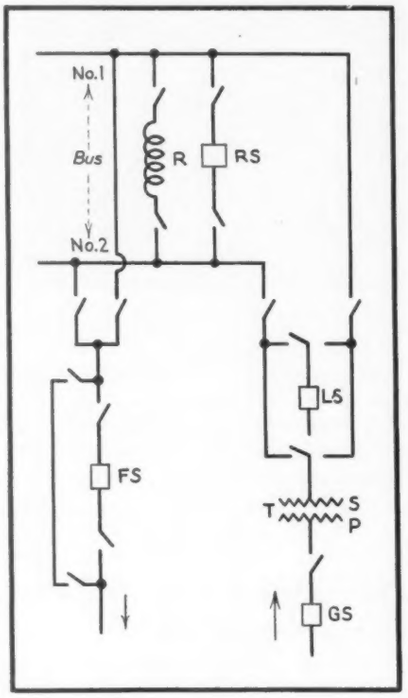
PROBLEM

A proposed plan for bus oil-switch protection is submitted for comment. Functioning of the proposed arrangement shown in the diagram is as follows:

The reactor switch (RS) opens when and if feeder oil switch (FS) fails to open on disturbance or trouble, connecting the reactor in series with the fault. Transformer or bus oil switch (LS) protects the transformer (T) on occurrence of trouble on either No. 1 or No. 2 bus. The feeder should be on one bus and the transformer on the other. Tripping time of oil switch should not exceed 25 cycles and relay operations should not exceed 14 cycles.

Feeder switch should trip out before bus switch. If the feeder switch fails to open, of course, the trouble would be intensified by the capacity of the station or system. Interrupting capacity of the oil switch should be such that the r.m.s. amperes do not exceed the rated kva. at its rated voltage.

Should, however, the bus switch or its control be out of service for inspection, etc., the feeders may be put on the other bus, in which case the reactors are disconnected and there is only protection on the feeder switch.—*P.W., Togus, Me.*



Schematic diagram of connections. FS=Feeder oil switch. R=Reactor. RS=Reactor short-circuiting switch. LS=Transformer oil switch on low-tension side. T=Transformer. GS=Transformer oil switch on high-tension side.

ANSWER

The plan might possibly be considered as new in the sense that no switching plan with such a profusion of disconnect switches in combination with the current-linking reactor and its associated circuit has ever been used to the best of our knowledge.

The plan appears not to achieve the desired objective because if the feeder breaker does fail to clear a feeder fault the reactor is cut into the circuit, but no provision is made for clearing the fault. Any other feeders taken from the bus would be subject to reduced voltage while the reactor is in the circuit between the transformer and the feeder bus.

There is no suggestion of intent to use a feeder breaker with an interrupting rating which would be inadequate to interrupt the fault current without the current-limiting reactor. The reactor and its associated short-circuiting breaker might well, therefore, be omitted, together with numerous disconnecting switches and the back-up relay arranged to trip the transformer low-tension switch for the back-up protection.—*H.D.B.*

2. FREQUENCY CHANGER PRIMARY-SECONDARY VOLTAGE

PROBLEM

A frequency changer has a stator wound for 220/440 volts, three phase, 60 cycles and a rotor for 165 volts, three phase, 90 cycles. Power is supplied from a transformer at a voltage not lower than 500 volts.

The stator appears to be connected single delta for 400 volts and double delta for 220 volts. When the stator is connected for 440-volt operation and 500 volts is applied, 220 volts is obtained at the rotor terminals.

Is there any way to change the stator connection to overcome this trouble? What would be the result if line voltage was raised to 540 volts, which can be done, and reconnect frequency changer windings to single star?—*L.M.S., Cleveland, Tenn.*

ANSWER

Considering that the frequency changer is used in an industrial application:

Reconnecting the windings from delta to wye or star, as you suggest, would require that 762 volts be furnished instead of 440 volts, to produce 165 volts, which is full load value.

Would suggest connecting a small air-cooled auto-transformer in the 500-volt circuit to furnish 440 volts to the set. As only about 10 percent reduction in voltage is required, a transformer of 10 percent of the kva. of the load will be required; that is, 500/440 volts times rated current input to the converter.—*F.H.P.*

SWITCHGEAR FOR YOUR ENTIRE STATION

ALL BUILT TO WORK TOGETHER

1. **Metal-enclosed Duplex Switchboards** for centralized control and metering.
2. **Metal-enclosed FH Cubicles** for main power circuits, complete with air-blast or low-oil-content circuit breakers and all necessary primary equipment.
3. **Metal-enclosed Reactor Equipments** for the feeder circuits.
4. **Metal-enclosed Cable Entrance Equipments** for the feeder circuits.
5. **Metal-enclosed Bus Runs** for all primary connections.
6. **Metal-clad Switchgear** for the medium-capacity auxiliary circuits, complete with air or oil circuit breakers.
7. **Metal-enclosed Drawout Air Breaker Equipments** for the low-voltage auxiliary circuits, complete with circuit breakers, buses, interconnections, and interlocks.

SELECT ALL YOU NEED . . . at one time

INSTALL IT ALL . . . as a unit

- ★ A single transaction—one company responsible
- ★ Speedy, easy installation at low, predictable cost
- ★ It's all designed as a single unit—complete co-ordination of all functions
- ★ Increased safety and operating dependability

THESE are our *standard* switchgear equipments—but they're tailored for today's tremendous wartime requirements.

You can select them easily, get them soon, put them on the job weeks sooner than is possible with non-standard equipment. They're fully co-ordinated and metal-enclosed, giving greater-than-ever dependability to stations supplying power for today's *must* production.

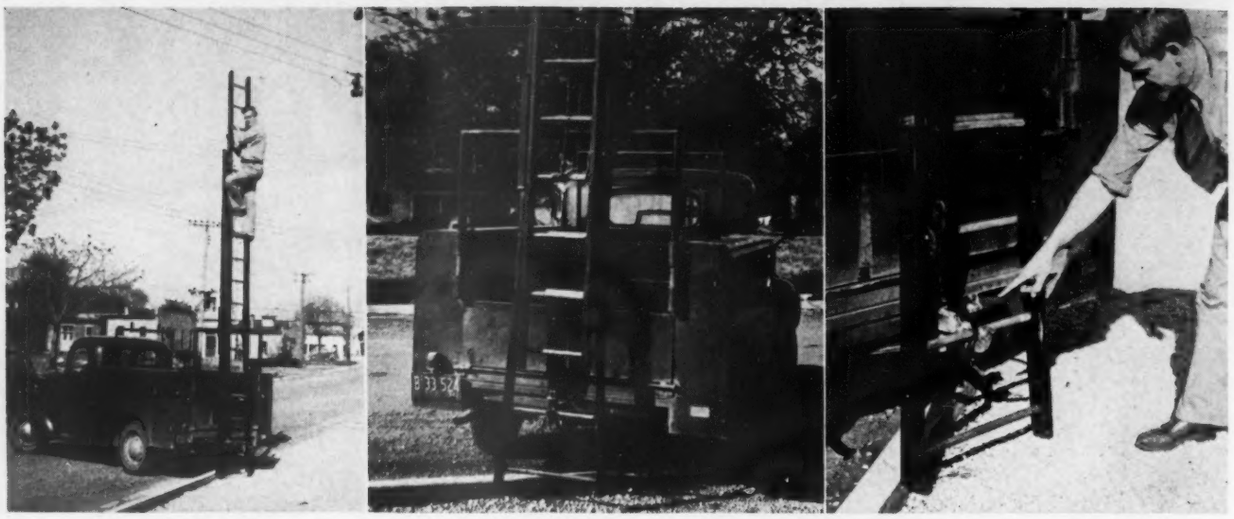
Simplifies Over-all Station Design

When you select *any one* of these metal-enclosed equipments you get it ready to set in place and connect. You save installation time, and space as well.

When you select *a number*—or all—of these equipments, you get more of these savings in time and space, *plus* an extra degree of over-all co-ordination that may make possible a simplification of your entire station design. What's more, all you need do is send us a simple one-line diagram showing the equipment you need. We'll go right to work on *standard* equipments. Ask your G-E office for our new bulletin, GEA-3742. Or write to *General Electric Co., Schenectady, N. Y.*

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC



VERTICAL suspension ladder mount for changing-out center suspension street light globes and lamps

Street Light Ladder Mount

Shown in the accompanying illustrations is a 20-ft. street light extension ladder for a pick-up type truck, designed by H. D. Gibler, Central Illinois Public Service Company, Fairbury. Used to replace center-suspension and bracket-type street light globes and lamps; the ladder slides in two channels and hinges on the pipe framework, visible at the rear of the truck. In an upright position the ladder is fastened to the pintle of the truck by means of a strap-type brace. It is reported that under test the ladder has been found perfectly safe and rigid even during high winds. When not in use the ladder lies on top of the truck supported by the pipe framework.

•

Frequency Sensitivity by Resonant Fork

By H. L. CLARK
General Engineering Laboratory,
General Electric Company, Schenectady, N. Y.

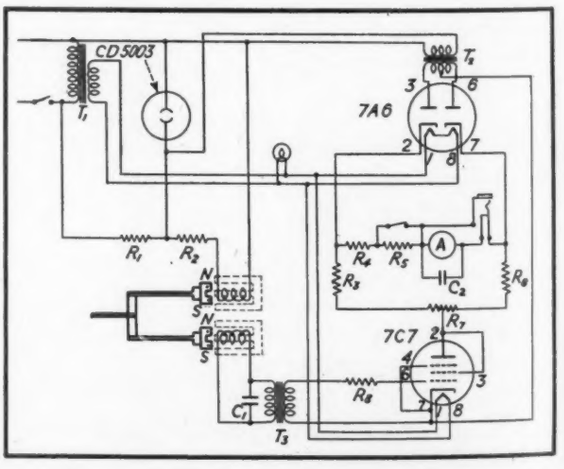
A new frequency meter, instead of using the customary tuned electrical circuit, makes use of a mechanical tuning fork to obtain its frequency indication. Resonance of a mechanical system, particularly of a tuning fork, is much sharper than that of even the best electrical circuit. This is again shown in this new frequency meter, where the widest possible scale range is 59.75 to 60.25 cycles per second. Commercial frequency meters have used a resonant electrical circuit for frequency discrimination and the most popular commercial instruments in the G.E. line have scale ranges of 55 to 65 cycles per second; the most accurate instrument available reads 59.5 to 60.5 cycles.

The new mechanical-resonance instrument, as designed, is contained within a metal case approximately 5 x 7 x 10 in. high and is marked with two scales, one 59.75 to 60.25 cycles per second, the other scale 59.875 to 50.125 cycles. Selection between the two scales is made by means of a toggle switch on the instrument panel. Unlike the usual indicating frequency meter, this new instrument may also be used as a power unit of a recorder simply by plugging an appropriate recording microammeter in the jack provided on the back of the instrument case.

Accuracy of tuning fork is such that the over-all instrument accuracy depends only on the accuracy of reading the indicator. The present instrument has a scale of 59.875 to 60.125 cycles per second with each of the 50 small divisions equal to 0.005 cycle, so that the accuracy is 0.005 cycle in 60 or 1 part in 12,000, not estimating parts of smallest scale divisions.

Voltage-frequency to be measured is applied to the transformer T_1 which supplies a low voltage for the heaters of the two vacuum tubes and for the pilot lamp. The type CD5003 neon glow lamp working in conjunction with resistor R_1 serves to square off the applied wave practically to eliminate any effects of harmonics or voltage variation.

This squared wave is applied through resistor R_2 to a small electromagnet, which, in turn, drives the tuning fork by means of the permanent magnet mounted on the end of one prong. The relative phase angle between this driving force and the resulting motion depends on the relation of the applied frequency to the



SQUARED WAVE (eliminating harmonics and voltage variation) drives turning fork which also generates voltage proportional to its motion; unbalance of polarized half-waves deflects the indicating instrument proportional to phase differences; sensitivity 50 times that of best listed commercial frequency meter of electrical-resonance principle

G-E

Wiring Materials Distributors

Will Help You Obtain Wiring Efficiency for Wartime Needs

H. R. Gray, salesman for the General Electric Supply Corporation, Baltimore, Md., often contacts war project customers by telephone to give them better service. Here he is giving advice on materials for special war work to a general contractor.

Dependable, easy to install conduits, cables, wires, and wiring devices are handled by all G-E Wiring Materials Distributors. One of them is located right in your own district. These Distributors are neighborly and friendly. They want to aid their customers every way they can.

A representative of your G-E Wiring Materials Distributor will be glad to help you select wiring materials for new war projects . . . for conversion of plants to war production . . . for maintenance. His knowledge of materials will enable him to help you solve wiring problems. He'll help you plan wiring, too, for plant protection with suggestions on materials for alarm systems, communication systems, light control systems.

The wide variety of materials handled by G-E Wiring Materials Distributors enables you to obtain suitable materials to meet your wartime needs efficiently.

D. B. Chandler (left), president and manager of Mid-State Electric Company, Inc., G-E Distributor, Lynchburg, Va., with A. E. Foster, stock clerk, is selecting suggested materials for wiring system in army shoe factory extension. Service is speeded by helping customers pick suitable materials for buildings needed in war effort.

J. E. Swartz, salesman, General Electric Supply Corporation, Philadelphia, Pa., is here checking with C. Zink, truckman, on delivery of materials needed immediately for a factory engaged in essential war work. Note loading facilities with three trucks backed against platform.

G-E WIRING MATERIALS
See the nearest G-E Wiring Materials Distributor about G-E conduit, boxes and fittings, wire and cable, and wiring devices for your special requirements. Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

Walter J. Mulhall (left), salesman for the E. B. Latham Co., Newark, N. J., helps his customers select materials. Here he is discussing G-E switches for war production plants with Harry Bagwell, purchasing agent for large electrical contractor for industrials.

GENERAL ELECTRIC

resonant frequency of the fork. The second magnet generates a voltage in its coil proportional to the motion of the fork. This voltage, applied through transformer T_3 to the control grid, makes the 7C7 tube alternately conducting and non-conducting.

The square voltage wave is also applied to the full-wave rectifier type 7A6; the positive and negative half-cycles, kept separate in resistors R_3 and R_6, both return through the 7C7. At 60.00 cycles, the resonant frequency of the fork, the 7C7 cuts off in the middle of the half-cycles so that the positive and negative quarter-cycles of current through R_3 and R_6 are exactly balanced and the indicating instrument "A" stands at its mid-scale point marked 60.00. Any change in the applied frequency causes a corresponding change in the phase angle of the 7C7 cut off and results in an unbalance in the R_3-R_6 currents to give an instrument indication of the frequency.

•

More Steam — How?

9. Slag Removal*

By ALFRED IDDLES
Application Engineer Babcock & Wilcox Co.

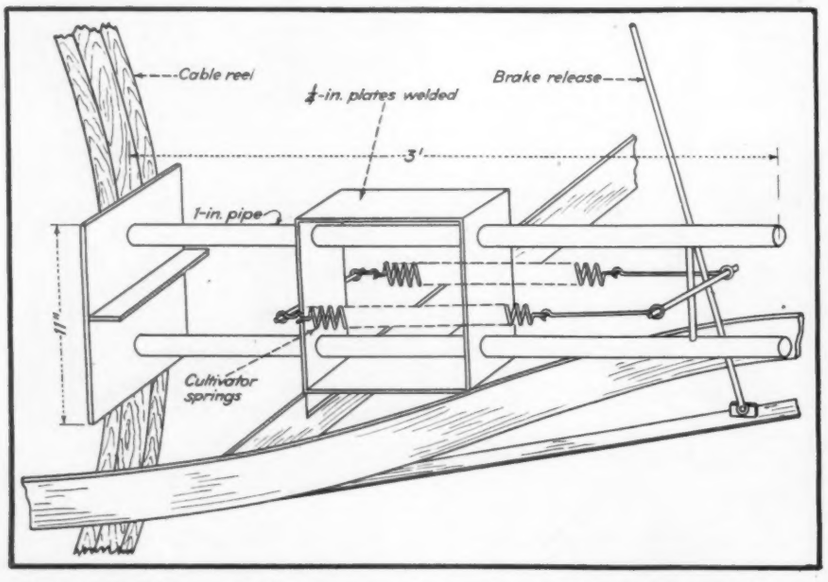
Mechanical devices for removing slag in all kinds of form—molten, thin, thick, dry, or what not—are available for nearly all conditions that one may meet. Naturally there are closely spaced tubes from which no blower can remove material. If one goes the limit and tries to accomplish this by water, then these tubes may be damaged. This is certainly true of alloy superheater tubes.

In general the improvement in mechanical cleaning devices depends upon the use of large quantities of steam or air for short periods of time, utilizing the fact that quantity of force applied is frequently the determining factor and not the time over which it is applied. What this means is so-called mass blowers. These are either (1) of the ordinary soot blower element type with multiple nozzles located far enough from the tubes so that these high mass flows can be obtained without resulting in tube cutting, or (2) retractable single nozzles of the type which project into the furnace when needed, either just through the wall or on into the furnace opposite convection surface and arranged for steam, air, or water jets for forceful application of cleaning fluid progressively across the unit either by lateral movement or by rotation.

Most of us, I believe, are familiar with this, but I want to emphasize the need for large quantities of cleaning fluid. It is the great force and commotion produced thereby which does the good work.

*This series began in the May 16, 1942, issue of "Electrical World," adapted from author's talk "What the Operator Wants to Know" to Steam Power Division, A.S.M.E., Metropolitan Section, March 25, 1942.

TRACTOR and reel work smoothly with aid of adjustable brake (see arrow)



ARRANGEMENT of reel brake showing parts largely assembled from material in hand

•

Cable Reel Brake Prevents Kinking

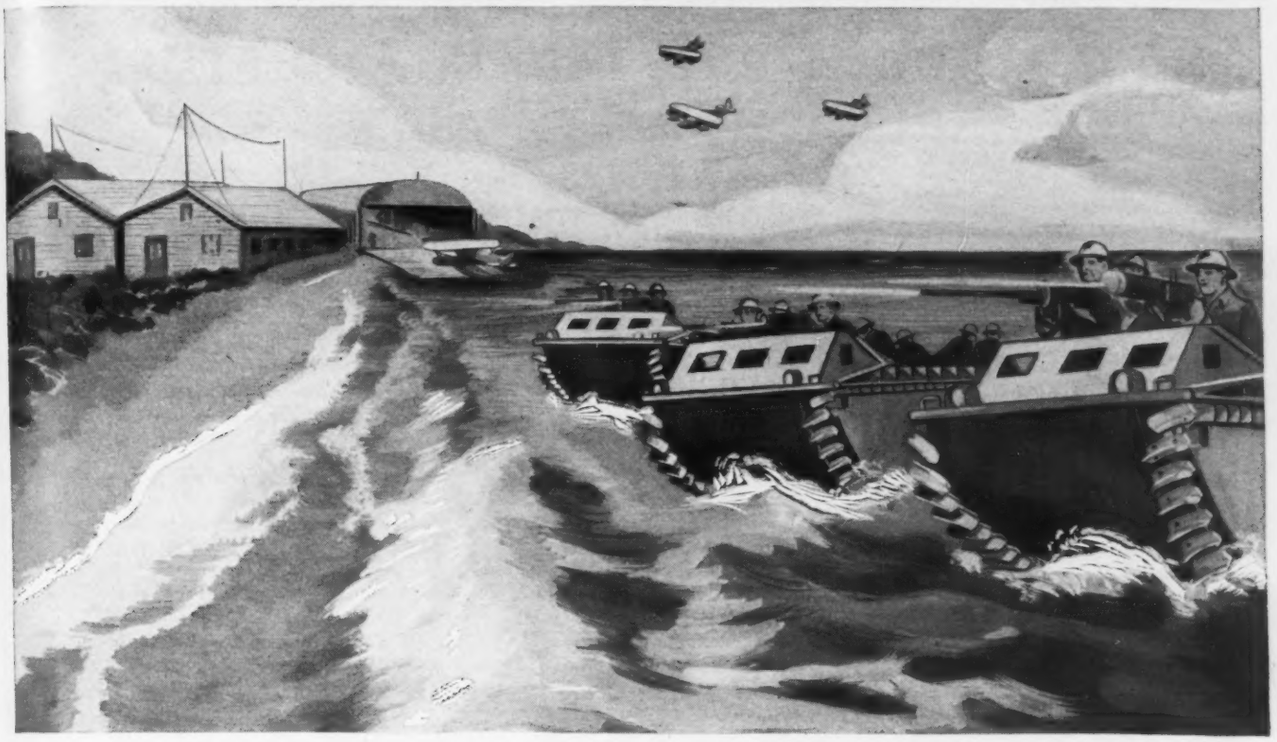
By J. M. DYER
Transmission engineer, Southwestern Light & Power Company, Lawton, Okla.

Southwestern Light & Power's method of stringing wire is to mount the reel on a cart, tow it with a tractor and allow the cable to pay out as the unit progresses, this sufficing when using aluminum, or light copper conductors. When stringing heavy copper and copperweld conductors it was found that when the tractor stopped the reel continued to turn for a short time and to pay out wire on account of the angular momentum. Considerable slack resulted, with kinking, which was hazardous and difficult to stop by trying to halt the reel by hand.

To eliminate this difficulty, a reel brake was designed and built by the construction department, as illustrated. This brake drags on the reel all the time wire is being paid out, the friction being just enough to stop the rotation when the tractor stops. When desired to let the brake run free the brake release handle may be pulled forward, removing the spring pull from the brake rods.

The entire assembly was welded together from junk pipe, plates and bars, the only items purchased being the two springs (cultivator springs).

AN ELECTRICAL WHOLESALER HELPS SPEED WAR PRODUCTION



WESCO teamwork met "impossible" air base test

WESCO SPEEDS PRODUCTION

* War plant manufacturing basic ingredient of TNT got needed equipment from Wesco in 2 days. Manufacturers promised delivery in 8 to 15 weeks.
* Airfield was saved 81 days' delay on delivery of 68 electrical items. Fastest complete delivery by manufacturers was 12 weeks. Wesco required only 3 days.

WESCO SERVES BUSINESS

* By assembling all parts of an order in one shipment.
* By furnishing informative and technical data.
* By knowing local and national codes and rulings.

The name that means everything in electricity

Five Houses Pooled Stocks and Supplied 14 Products in Quantity in 12 Hours

At a new Marine Air Base on the Southeast Coast, office buildings sprouted over night. Even roofs were in place but no order had been given for electrical equipment. At 3 P. M. one day the contractor handed the complete bill of material to the local Wesco House and required delivery the next morning.

Fourteen different products were involved, all in quantity. Included were 200—40-Watt Fluorescent Industrial Units, 12 transformers of 3 types, panels, safety switches, cable, conduit and fittings. Local stocks could furnish some of the items. Telephoning the 4 nearest Wesco Branches, the local House rounded up the complicated order, piecemeal. Everything started forward that afternoon and the contractor went to work the next day.

Wesco teamwork has performed many "impossible" tasks for industry. Today that ability speeds the war effort—but it will again serve business in the reconstruction to come.

Westinghouse

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HOW TO CONSERVE, REPAIR AND STORE RUBBER SAFETY AIDS

By CHARLES A. COUTTS*
Safety Engineer Bureau of Safety, Inc., Affiliate of Middle West Service Corporation, Chicago, Ill.

Recent tests and the experience of several users of rubber protective equipment indicate that certain types of rubber gloves, rubber blankets and rubber sleeves may be repaired by vulcanizing with complete safety if sufficient care is used in applying patches and if repairs to rubber gloves are limited to the gauntlet portion.

Rubber blankets and rubber sleeves may be repaired with safety at any location on their surface. Line hose and insulator hoods should not be repaired by vulcanizing as the nature of these items and the type and thickness of the rubber do not respond to ordinary vulcanizing methods.

PRECAUTIONS IN PATCHING RUBBER GLOVES, SLEEVES, BLANKETS

1 Apply patches in all cases to both sides of the hole or tear, both inside and outside the gloves, blankets and sleeves. If the snag or tear leaves a void, it should be filled with the same type of rubber used in the patch.

2 Since rubber gloves that are snagged or torn sometimes tend to tear further at point of tear or snag very easily, a punch should be used to cut a circular hole at each end of the tear or at each sharp edge. A rounded surface offers considerable resistance to further spread of the tear or snag.

3 Patches should be applied only to equipment which is proved to be of good live rubber by inspection. The older varieties of rubber gloves should not be repaired.

4 Patches should be applied to gloves only on the gauntlet portion. Records kept in several glove testing laboratories have shown in the past that approximately 70 per cent of rejections in electric tests are from defects and failures at this location. Sleeves and blankets may be patched at any location on their surface.

5 Rubber protective equipment should pass a rigid electrical test after repairs are completed. This test should be the same as that used in testing new equipment and should follow the methods set forth in Safe Practices Pamphlet P.U. 3 of the National Safety Council. Rubber gloves should also be inflated to three times their normal size and inspected for cracks and checks at the patch location. After deflation the glove and patch should return to its original shape. Thickness gauges should be used to determine whether or not there is any thickening of the rubber in the gloves. Rubber blankets should be wet tested after repairs are made.

6 Only the "Shaler type" patches should be used and efforts to economize by substitution should not be considered. This patch should be applied exactly according to directions and in addition the rubber surfaces after roughing should be softened by a suitable benzole solvent. Rubber cement should then be applied and allowed to dry completely, preferably an hour or more, before applying the vulcanized patch.

7 Holes or tears which are more than ½ in. in length should not be patched.

8 Cold patches should never be used as results prove them unsatisfactory and unsafe. From experience it has been found that cold patches become loose after considerable period of usage.

TESTS OF PATCHED 16,000-VOLT-RATED RUBBER GLOVES

Only one patch is applied to each hole or defect (and that on the outside of the rubber glove) of modern gloves which had failed in the regular periodical electrical tests. Gloves then inflated to three times normal size and inspected for cracks or checks and failure of patch.

Test No.	Type of Patch	Test Voltage	Leakover Amp.	Breakdown Voltage	Inflation Test	Where Breakdown Occurred
1	Elec. spotter	10,000 V. 3 min.	3	15,000 V.	O. K.	In patch
2	Elec. spotter	10,000 V. 30 sec.	3	10,000 V.	O. K.	In patch
3	Elec. pad	10,000 V. 3 min.	3	20,800 V.	O. K.	Orig. rubber
4	Shaler patch	10,000 V. 3 min.	3	17,250 V.	O. K.	Orig. rubber
5	Cold patch	10,000 V. 3 min.	3	13,750 V.	O. K.	In patch

RECOMMENDATIONS FOR PROPER STORAGE

In order to conserve present supplies of rubber protective equipment proper methods of storage and handling are vital. Practices found to be helpful in prolonging the life and usefulness of this equipment follow:

(a) Store rubber goods in a cool, dry place and take extra precautions at this time against loss or damage from fire.

(b) Store rubber gloves and other protective goods in suitable containers when carried on line and service trucks to prevent tears, snagging or injury. Do not store rubber protective equipment in a distorted position so that the strain is placed on the rubber. Do not fold. In storing rubber gloves do not pile directly on top of one another but store in suitable cartons.

(c) Always reverse and dry rubber gloves after using so that oxidation would not result in checking and deterioration.

(d) Wear suitable protectors with high gauntlets when using rubber gloves to protect the cuffs from injury. The protector made with a rubber gauntlet allows maximum protection.

(e) Do not allow oil or other greasy material to come in contact with rubber protective equipment.

(f) Test rubber protective equipment at regular intervals, both visually before using each time and by means of periodical inflation and electric tests.

(g) Wash and disinfect rubber gloves at intervals when testing is done. Proper dusting with commercial talcum will impart a nonslippery surface to the gloves and will make for ease in drawing them on.

*Adapted from a paper appearing in *National Safety News*, official organ of the National Safety Council.

999 Capacitors in One 15,000-Kva. Block

Anticipating that changes in system capacities and loadings might very readily remove the need for large corrective capacity required at one point by present conditions, engineers of a Middle Atlantic power company decided to make the installation in as flexible a manner as was possible. That decision ruled out a synchronous condenser on account of the difficulty of dividing it up into smaller capacities when and if such action should be desirable. Capacitors were the indicated answer. And, having a rating of 2,500 volts, the capacitors could be reinstalled in blocks of any capacity up to the limit of their total kva. anywhere on the system on circuits having a nominal voltage of 2,500, 4,100, 7,200 or 13,600 volts.

To provide a flexible installation so that r-kva. could be used in relatively small blocks according to the varying requirements of system correction, the installation was made in six sections as shown on the accompanying diagram. The correction was applied to a substation in which there is a 13.6-kv. and a 7,200-volt bus. As the load cycle of both buses closely follows the system load cycle, the installation of capacitors was proportioned to the load on each bank, thereby providing improved regulation to the station buses and at the same time utilizing the station transformers for coupling to the system.

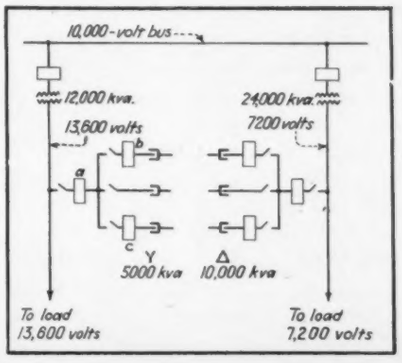
On the 13.6-kv. bus the 333-2,500-volt units are 3-series, Y-connected, with units paralleled and connected in three groups of approximately 1,667 kva. each. Oil circuit breaker (a) is automatic and is of sufficient capacity to interrupt a fault on the bus. This breaker also controls one group of capacitors. Breakers (b) and (c) are smaller breakers and are used only for control of their respective capacitor groups.

On the 7,200-volt bus 666-2,500-volt units are 3-series delta-connected, with units paralleled and connected in three groups of approximately 3,333 kva. each. The control is similar to the control of the 13.6-kv. bank.

There are 999 15-kva., 2,500-volt capacitors, totaling 14,985 kva., in the installation. On the 13.6-kv. bus 333 units, or a capacity of 4,995 kva., operate at slightly above rated voltage, which gives an output somewhat above the kva. rating of this group. On the 7,200-volt bus the 666 capacitor units operate at slightly under rated voltage, so the output of this group is slightly under 9,990 kva. The net output adds to approximately 15,000 kva.

The building is ventilated by screened openings located at frequent intervals just above the floor along both side walls and with two 10,000 C.F.M. 36-in. ventilating fans, one in each gable end of the building. Uniform cooling is obtained and a maximum temperature rise of 22 deg. has been observed.

As appears in the accompanying pictures, the units are set in angle iron troughs which are mounted on bus insulators. Close examination shows that there are three triple racks in each of three tiers.



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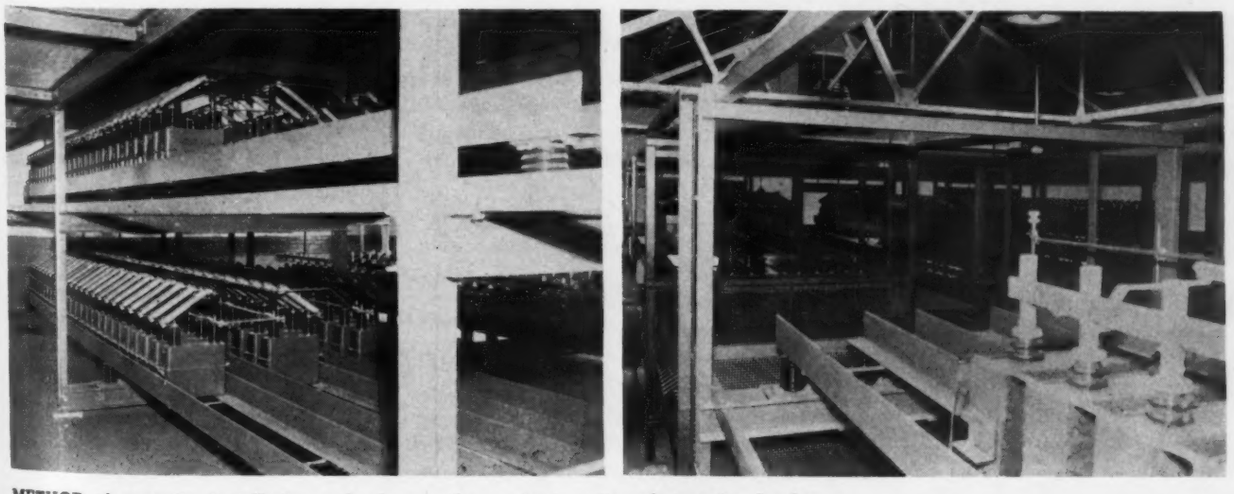
Bettering Quarry Drive Conditions

General practice in rock quarries is to install motors large enough to carry the maximum load which can normally be imposed on crushers, resulting in underloading when the crushers are partially or wholly empty. In a large traprock quarry suffering from poor voltage regulation and low power factor continuous loading of the primary rock crusher was not feasible and there were many intervals where both primary and secondary crushers were not loaded coincidently or alternately. The primary crusher which handles rock pieces up to 1 ton was belt-driven from a heavy two-bearing shaft, which in turn was driven by a direct-connected 500-hp. slip-ring motor. Most of the difficulty occurred when the primary and secondary crushers were partially empty at the same time, and this happened frequently.

When particularly large single rocks were dumped into the main crusher the momentary load on the 500-hp. motor touched 1,200 hp. and then gradually tapered off. With a frequent load drop to 20 to 30 percent of the motor rating over a period in



METHOD of capacitor installation and, above, scheme of connection of capacitor banks

operating this crusher the power factor fell to less than 50 percent. Sudden imposition of a heavy load caused violent voltage fluctuations, and at times the slip-ring motor control would trip, shutting the machine down and leaving the crusher full of rock. This often led to removal of rock by hand and adversely affected customers further along on the transmission line, especially those with synchronous motors.

Investigation by the supplying power company led to the installation of a 500-hp. synchronous motor direct-connected to the end of the shaft, opposite the slip-ring motor. This synchronous motor was designed for extra field excitation and was guaranteed to have a 250 percent pull-out torque. All starts are made with the slip-ring motor, and when it is up to normal speed the synchronous motor is manually thrown on the line and the slip-ring motor switch opened. Thus, the synchronous motor picks up the load and carries on, and the free-moving slip-ring motor provides a balance weight at the end of the shaft. This solution brought the power factor up to about 80 percent and the voltage regulation was satisfactory for both the quarry and the other customers served by the same transmission line. The case does not illustrate a "cure-all" type of solution, but under the conditions then prevailing as to equipment availability it illustrated an attack upon the problem at the source and was logical from the standpoints of operation, economy and practicality.

•

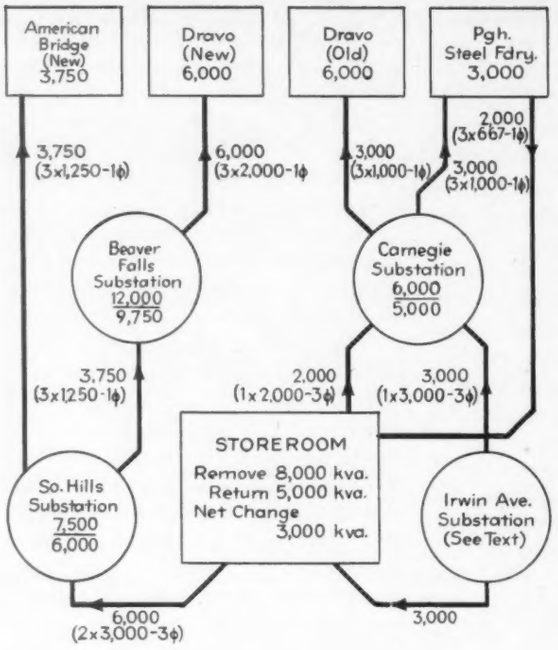
Nine Transformer Shifts Save Copper

By B. M. JONES

Planning Engineer,
Duquesne Light Company, Pittsburgh

Early this year it became apparent that a considerable amount of power transformer capacity would be required for large war customers and a nine-way transformer swap (see illustration) provided 13,750 kva. of transformer capacity for four large war customers without the purchase of any new transformers.

This involved drawing upon the storeroom for only 3,000 kva. of transformer capacity. At the same time sufficient spare transformers of the various sizes and types were retained to facilitate repairs in case of breakdown.



TRANSFORMER capacity of 13,750 kva. for four large war-work customers obtained without purchasing any transformers and drawing only 3,000 kva. from storeroom. Upper and lower figures in circles (company substations) are for former and resulting capacities respectively

Some of the installations were indoor and some outdoor and they required different space and headroom. It was also necessary to arrange the swapping so that banks of similar impedance would be installed and operated in parallel at the same location to provide adequate capacity, this being necessitated by material difference in the impedance of the 1-phase unit (4.6 percent) versus impedance of the 3-phase units (8.0 percent).

Since the national defense program became so intense last year our company decided to use most advantageously the reserves throughout the system. Therefore the two 2,000-kva. banks in service at Irwin Avenue substation could be retained; the 3,000-kva. banks purchased for that substation and delivered there but not installed to date would be utilized elsewhere.

The total amount of new money required will, of course, be relatively small, and consists of miscellaneous materials, labor, drayage and a small amount of rearrangements in the various stations. However, the accounting matters were just the same as if we had had to purchase every one of these transformers from the manufacturers.

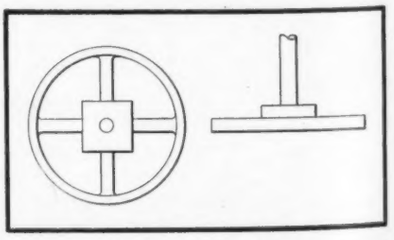
While many other swaps of equipment, including circuit breakers, regulators, disconnecting switches, as well as power transformers, have been made for a number of years on our system with the objective, of course, of matching the capacity to the load in various spots, this is the most involved swap of major equipment to date.

This move was made, of course, to utilize the existing equipment by making the necessary swaps to avoid the use of critical materials, particularly copper, iron and steel, and no demands were placed upon the manufacturers for any transformers.

•

Handle Bushings on Pedestal Wheel

High-voltage bushings, large, heavy, of awkward shape and easily damaged, are difficult things to handle in the repair shop. Chain falls on trolley tracks and dollies with frames to fit the bushing flanges are frequently used. In the shop of the Carolina Power & Light Company a different, simpler and, it is stated, perfectly satisfactory method is employed. The device used is a wheel about 2 ft. in diameter with a steel rod rising from its center. The center tube of the bushing is slipped over the rod and the bushing stands upright on the pedestal. When it is to be moved the bushing and pedestal are tilted and rolled about on the wheel base of the pedestal.



BUSHING HOLDER is also handling means

Anne Clark's refrigerator is helping to flatten Essen

If you have ever tried to lift a mechanical refrigerator, you know the weight of metal that is in them. So when Uncle Sam diverted to munitions all the critical materials in these precision machines, he took a long step toward shortening the war. Equally important, he gained the use of some of the world's foremost manufacturing plants with their skilled management, trained workers, and productive machinery.

In many of these plants, conversion from refrigerators to war materials was speeded up and made smoother by the cooperation of the Revere Technical Advisory staff. For Revere not only furnishes industry with sound copper alloys, but also supplies practical assistance in methods of processing and fabricating.

Today, every ounce of copper goes directly into the essentials of warfare. There is none for any other use. Fortunately, Revere is well prepared, with modern plants, improved machines and advanced techniques, to fill a heavy share of our country's needs. And in Revere's laboratories research is tirelessly pressed forward to help shorten the hours before victory.

The Revere Technical Advisory Service functions in (1) developing new and better Revere materials to meet active or anticipated demands; (2) supplying specific and detailed knowledge of the properties of engineering and construction materials; (3) continuously observing developments of science and engineering for their utilization in production methods and equipment; (4) helping industrial executives make use of data thus developed. This service is available to you, free.

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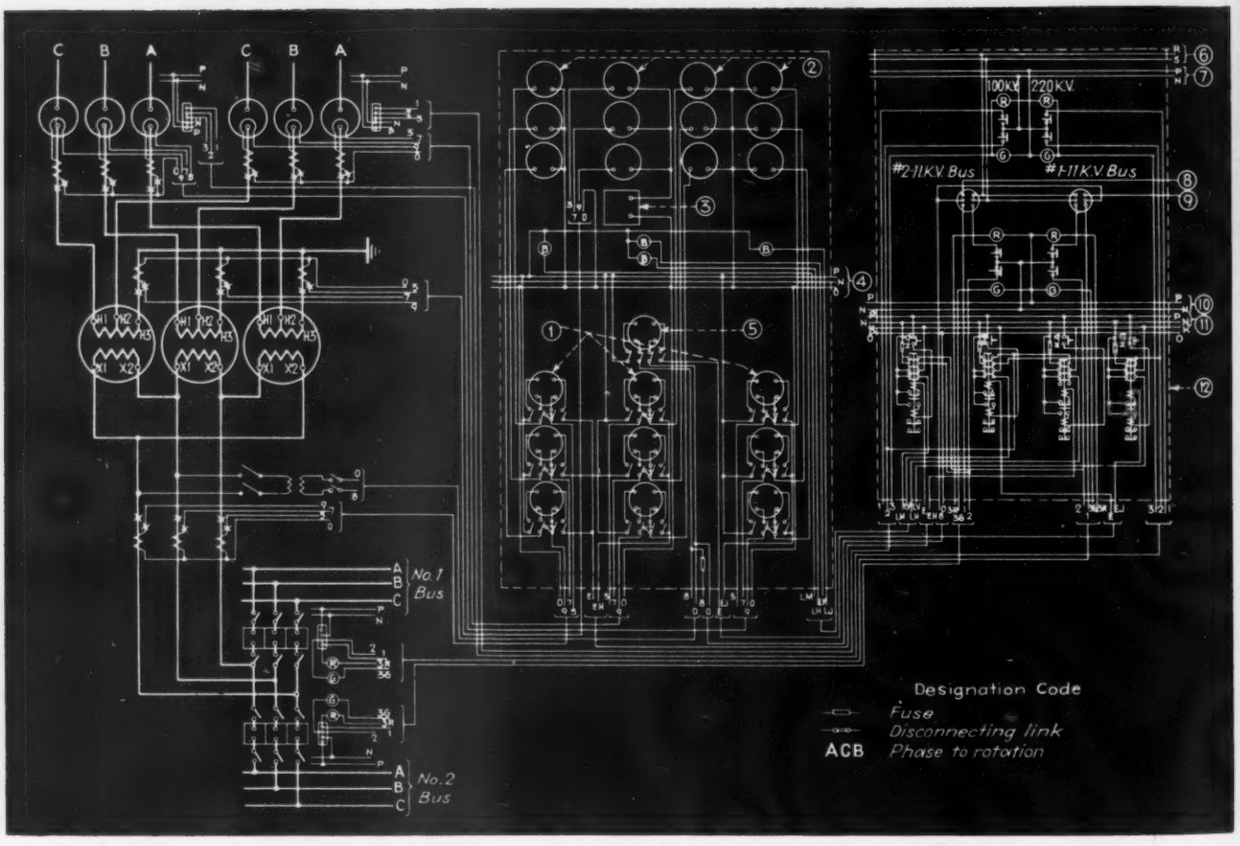
HOW TO CONNECT

Controls, Meters and Relays for Three-Winding Transformer Banks*



References for circled numbers on diagram:

1—Overcurrent relays (left to right rows) 11 kv., 100 kv. and 220 kv.

2—Ammeters (left to right rows) 11 kv., neutral, 100 kv. and 220 kv.

3—Curve-drawing ammeter.

4—Auxiliary control.

5—Over-voltage

6—Synchronizing bus.

7—High-tension oil circuit breaker control.

8—No. 2 bus potential.

9—No. 1 bus potential.

10—Low-tension oil circuit breaker control.

11—Auxiliary control.

12—Auxiliary relays (left to right) OL-11 kv., OV-100 kv., OL-100 kv. and OL-220 kv.

*From a book of standards of a Western utility organization

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TO save critical materials such as nickel and chromium, "National Emergency Alloy Steels" have been developed as substitutes for the old style alloy steels. These new alloy steels cover a wide range of properties and were especially designed to meet present conditions. Many of them are actually out-performing the steels previously used.

Our stock of these "National Emergency Alloy Steels" is now coming in. We welcome your inquiries and orders and would be happy to assist you in determining the grades best suited to your needs.

Telephone, wire or write the Scully Warehouse nearest you—see phone and teletype numbers above.

Do you lack steel to complete a rush war job? Is your production in danger of being slowed down or stopped for want of some piece of steel or steel product? Then call the nearest Scully warehouse. Many such calls have kept wheels turning. If we don't have what you need, you can be sure that we'll do everything possible to help you get it.

Our first job, like yours, is to speed war production. Every one of our warehouses is on the job day and night. And although our stocks of steel are not what we wish they were, what we have can be yours in a hurry—subject, of course, to priority restrictions. So try Scully—note our phone and teletype numbers above.

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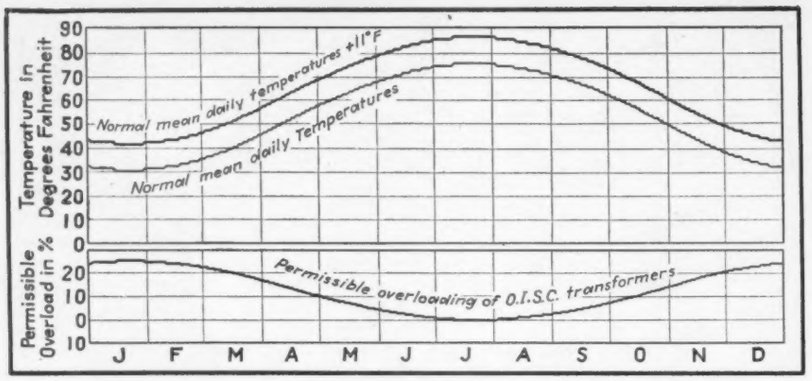
UNITED STATES STEEL



TRANSFORMER LOADING CURVE for Pittsburgh (oil-immersed self-cooled)

Based on weather data from Pittsburgh station, U. S. Weather Bureau, and on A.I.E.E. Guides for Transformer Operation, 1940 Edition. Only daily *mean* temperatures are used; lowest or highest recorded daily temperatures not considered. The permissible overloading is based on 1 percent of rated kva. for each degree C. that mean temperature is under 30 C. (0.55 percent for each degree F. under 86 F.).

Loading Curve for OISC Transformers

By L. A. TERVEN
System Planning Engineer
West Penn Power Company, Pittsburgh

West Penn Power Company has prepared the accompanying transformer loading chart for temperature conditions in its territory, based upon "Guides for Transformer Operation" of the A.I.E.E., 1940 edition.

The middle curve gives the average daily temperature in the Pittsburgh area from data of the United States Weather Bureau. To this curve 11 deg. F. is added, giving the top curve, which covers 90 percent of the time for daily plus departures from the long term mean. The peak of this curve is 86 deg. F. (30 deg. C.) corresponding to 75 deg. F. in the middle curve plus 11 deg. F. deviation allowance. The lower curve gives the seasonal overload permissible on the basis of the American Institute rule: "Oil-immersed self-cooled transformers may be loaded continuously 1 percent of rated kva. for each degree Centigrade that the daily average temperature of the cooling medium (air) is below 30 deg. C."

For the warmest days of the year (in July) the transformer has no overload rating, but for customary peak loads during the winter months the average daily temperature drops to 30 deg. F., which with 11 deg. F., plus departure from normal, gives 41 deg. F. (5 deg. C.), thus permitting an overload of 25 percent.

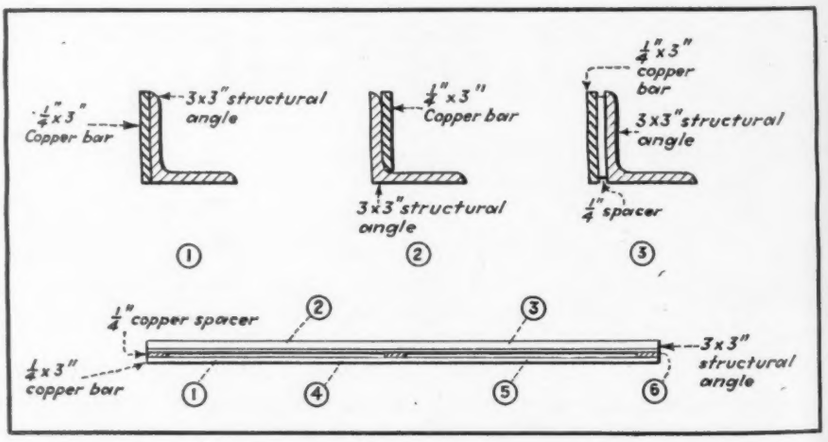
Heat storage of the transformer takes care of the temperature cycle during the 24 hours of the day, while the 11 deg. F. plus deviation allowance takes care of the departure from normal temperatures for 90 percent of the time. Finally, the character of the load takes care of exceptionally warm days which may occur during any of the seasons, because it is usual to have a peak load for more than three hours of continuous operation. There are times when the deviation of the normal mean temperature from the long time mean temperature for a single day is as much as 25 deg. F., but such cases are very rare and it would seem to be advisable to ignore them, since for short-time overloads the transformer life is reduced by a factor which depends upon the time—in this case quite short.

•

Devise Substitute for Tubular Bus

Unable to secure copper tubing for substation bus work, engineers of the Commonwealth & Southern Corp., Jackson, Mich., improvised an entirely satisfactory design by bolting available ¼ x 3-in. copper bar to 3 x 3-in. structural steel angle. The structural angle provided the necessary mechanical strength and made it possible to use the same bus spans as for tubular buses. Thus when copper tubing again is available it will merely be necessary to remove the improvised "war bus" and replace it with conventional tubing, without changing support locations.

Before this improvised bus was installed, tests to determine its current-carrying capacity were run, using three different locations and methods of mounting the copper on the angle iron: (1) Copper bar bolted to outside of one leg of the angle, (2) bar bolted to inside of one leg of angle and (3) bar on the outside of the angle but with ¼-in. copper spacers



ARRANGEMENTS of busbar and angle corresponding to readings in accompanying table; numbered designations of lower sketch indicate positions of thermometers

Temperatures of Angle-Plate Bus.

Arrangement	Amperes Flowing in Bus	Thermometer Readings — Deg. C. — Taken Along Bus 1	2	3	4	5	6	Room. Temp.
1	1,208	61.5	55.0	55.8	56.0	38.9	54.0	26.0
	1,588	79.8	71.0	74.0	75.0	....	....	24.2
2	1,088	50.0	54.0	55.5	46.8	....	....	23.0
	1,360	65.0	70.8	72.6	60.5	....	....	24.9
	1,508	79.0	85.0	86.7	70.2	....	....	25.2
3	1,132	55.8	54.5	55.6	37.0	....	....	25.0

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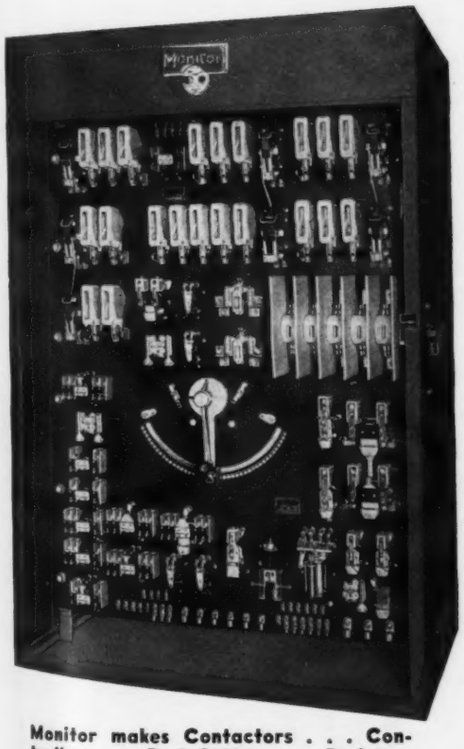
Many important firms producing or using electrically driven machines and tools employ without cost an expert in motor control — The Monitor Field Engineer. As close to you as your phone there's a factory-trained technician willing and able to assume full responsibility for correct controlling devices for new equipment or the maintenance of controls which now require servicing. He's a practical man with the latest data on control design, technical details, prices, delivery and priority rulings at his finger tips. Enlist his interest in your control problem without thought of fee or obligation.

Phone nearest Monitor office or wire Factory direct.



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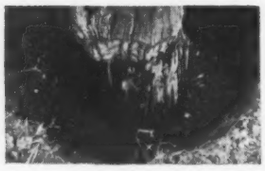
AVOID POSSIBLE POWER FAILURES

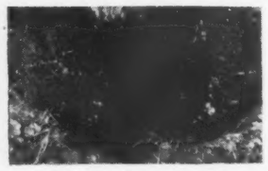
Osmoplastic groundline treatment increases standing pole life and provides lowest yearly pole maintenance cost

Osmoplastic applied to the groundline of standing poles prevents decay thus adding years to pole life. The toxic chemical salts in Osmoplastic penetrate deeply into the pole destroying the microscopic fungi roots. The coal tar, creosote vehicle in Osmoplastic remains on the outside of the pole providing a toxic armor insuring double protection.

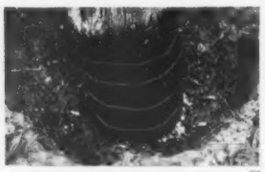
ECONOMICAL AND EASY TO APPLY



Dig earth from around pole to a depth of approximately 14 inches from the groundline. Then remove the loose decayed wood in the treatable zone.



Apply OSMOPLASTIC by brushing or daubing on the cleaned surface from 6 inches above to 12 inches below the groundline level.



Wrap the Osmose bandage around the treated area. This protects and retains the Osmoplastic until the Osmosalts penetrate into pole.

Back fill the hole and the operation is completed. The Osmoplastic protection adds many extra years service life to standing poles.

CHECK THESE MONEY SAVING OSMOPLASTIC ADVANTAGES

1 OSMOPLASTIC checks groundline decay and adds many years service life to standing poles, thus reducing costly replacements and power and communications interruptions due to pole failures.

2 OSMOPLASTIC enables utilities to treat their own standing poles with no specially trained workmen. Requires no costly equipment.

3 OSMOPLASTIC groundline treatment lengthens the cycle of scheduled pole inspections since Osmoplastic groundline treatment is effective for many years.

4 OSMOPLASTIC can be effectively used in the treatment of reset poles, or in reinforcement work using stubs of native wood species or cut sections from old poles.

OSMOSE

WOOD PRESERVING COMPANY OF AMERICA, INC.

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SEND FOR BULLETIN TODAY

Osmose Wood Preserving Company of America, Inc.
1437 Bailey Avenue, Buffalo, N. Y.

Gentlemen:
Please send me the new Osmoplastic Bulletin on treating utility poles.

Name_____

Address_____

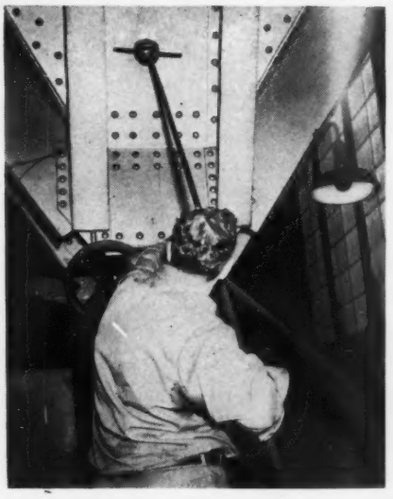
City and State_____

inserted between bar and angle for ventilation.

Highest current-carrying capacity was obtained with the bar bolted directly against the outside of the angle, which then acts as a radiating surface to dissipate heat. Where the bar and the angle were separated by spacers the surface of the bar alone did not provide as good a radiator and the combination ran hotter for the same current. Temperature rise data for the three arrangements are given.

•

Poke Rod Clears Jams in Coal Scale



Difficulties with moist coal arching and clogging in the automatic coal scales at the Cedar Rapids plant of the Iowa Electric Light & Power Company have been met as shown in the illustration by the installation of a port in the bunker through which a poke rod can be inserted to clear the jam. Clogging has been found to be worse during winter months, when temperature of the coal is low enough to cause the entrained moisture to freeze. Moisture in the coal is about 18 percent.

•

Portable Stool for Switching Operations

Permanent insulating stools at switch-handle locations in substations have long been a standard throughout the property of the Wisconsin Power & Light Company for use during high-tension switching operations. Recently, as an experiment, the portable stool shown was constructed at

If "Copperweld" didn't exist it would have to be created!

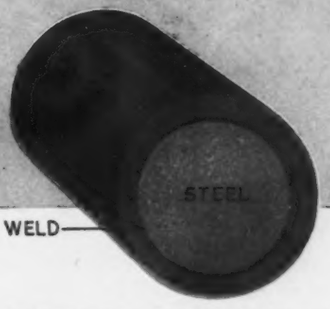
WAR eats copper in trainload bites. Copper metal goes directly into munitions and war materiel. And copper wires move and control ships, tanks, subs, planes and other war equipment. Power for war production is transmitted, controlled and created by copper.

Every pound of our Nation's copper supply must be conserved for victory — that's why a copper-saving material, like Copperweld, would have to be created, if it didn't already exist. Copperweld (copper-covered steel) saves up to 70% of copper. The steel core of Copperweld provides mechanical strength. Only enough copper is used to do the jobs that copper does best — conduct electricity and protection from rust and corrosion.

COPPERWELD STEEL COMPANY · GLASSPORT, PA.

Save hundreds of tons of Copper with COPPERWELD

(COPPER-COVERED STEEL)



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RETURN REELS AND SPOOLS PROMPTLY

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WHEN CONDUCTOR or room temperatures are high . . . when you get sudden voltage surges or temporary overloads . . . that's the place you can specify Roebling Varnished Cambric Insulation — conserve heat-resisting rubber for vital front-line duty.

CHECK OVER your wiring jobs where rubber was formerly specified. You'll find plenty where Roebling Paper Insulated Cable can now be used, circuits maintained without the need for priceless rubber.

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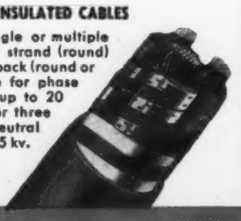
. . . available in single or multiple conductor, regular strand (round) or sector) and Compack (round or sector). Belted type for phase to phase voltages up to 20 kv. Shielded type for three phase grounded neutral circuits from 13 to 35 kv.

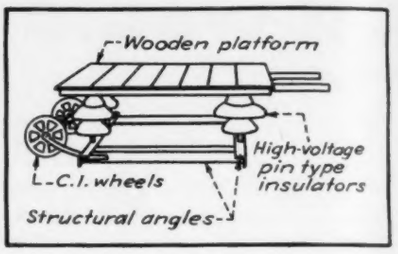


ROEBLING

ELECTRIC WIRES AND CABLES

one of the major substations to determine its practicability for such work. Wheels mounted on its structural steel base provide means for moving it from one switching position to another within the substation.

It is pointed out by the Bureau of Safety, a Middle West Service Company affiliate, in regard to this design that unless insulated stools are made in such a manner as to be readily accessible it has been found that workmen sometimes do not use them as required by the safety rules. Permanent stools are the real solution to the problem, but portable stools like this one do have considerable merit.



EXPERIMENTAL switching stool on wheels can be moved from one switching point to another

•

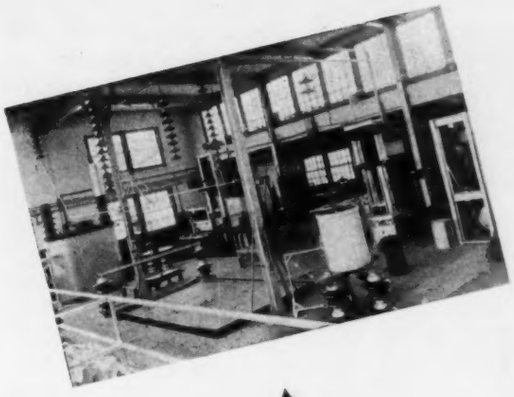
Heat Exchangers Add Capacity and Life

By C. E. BAUGH
Assistant Engineer
Pacific Gas & Electric Company

How conversion of old indoor, water-cooled transformers can show a tremendous saving of vital materials, particularly copper and steel, that would be required to build new units, was recently demonstrated by the Pacific Gas & Electric Company. Involved were seven very old 1,000-kva., water-cooled, 11,000/2,400-volt indoor transformers, which were of little value except as junk.

Proposals were made in 1937 to convert the transformers to self-cooled units on the basis of a rerated capacity of 500 kva. each, because the losses were so high that it was impossible to install sufficient cooling tubes for the original rating. Even at the 500-kva. rating, in view of the high losses, it was uneconomical to convert the transformers to self-cooled units for outdoor service.

The war emergency led to a further study of the possibility of converting these transformers and maintaining



Research

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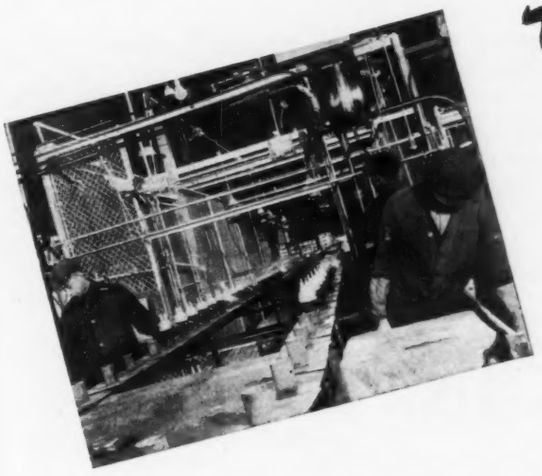

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FIRE and how to fight it!

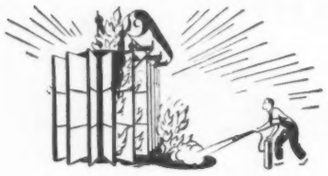
HOW DO YOU KILL FLAMMABLE LIQUID BLAZES?

Q. What are flammable liquid fires?

A. They are fires in oils, gasoline, solvents, paints, lacquers, and the like. Authorities call these Class "B" blazes and recommend extinguishers with a *smothering* or *blanketing* action.

Q. Will every type of extinguisher work on all kinds of flammable liquid fires?

A. No! Water streams, for example, are usually ineffective and extinguishers which employ a liquid stream will not handle three-dimensional blazes.



Q. What is a three-dimensional fire?

A. It is a fire which burns at more than one level, as when an oil-filled transformer catches fire and spills a flowing stream of burning liquid down its sides. Carbon dioxide extinguishers readily handle this type of fire. Work from the bottom up, when fighting such a blaze. Kill fire at the bottom level first.

Q. What is a running fire?

A. It is a flammable liquid blaze which occurs when a flowing stream becomes ignited. You fight this fire by working against the flow of the liquid. If a pipe is leaking, start at the extreme edge of the fire and work back toward the pipe. If a container is spilling its burning contents, work toward the container.

Q. What is a spill fire?

A. This is simply a fire resulting from liquid spilled on the ground or on the floor. Don't try to kill all of this fire at once, if it covers a large area. Start at one point, smother all flames there and continue, part by part, until the entire fire is out.

If you are outdoors, *keep wind at your back.*

MAKE EXTINGUISHERS LAST LONGER

Since December 1941 Walter Kidde and Company has had an unusual war job . . . to make products that *save* fighting men's lives. These products include high pressure containers for aviation use, special type built-in extinguishing systems, crash trucks, and various flotation equipment.

Since we have fewer Kidde extinguishers* to sell, we are trying to make your existing fire fighting units more effective.

If you want reprints of this series of advertisements, just write to

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Kidde

**formerly known as "LUX" extinguishers*

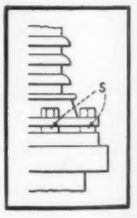
their original rating in the process. As a result of this study, seven heat exchangers, one for each transformer, have been purchased, the cost of each unit being about one-half the cost of conventional convection-type radiators or cooling tubes having an equivalent heat exchange capacity.

Each cooling unit consists of an extended surface, serpentine coil, a pump for circulating oil and two propeller-type fans for circulating air. With 13 g.p.m. of oil entering the cooler at 71 deg. C. and 2,600 cu.ft. per minute of air at 40 deg. C., each unit has a rating of 58,000 B.t.u. per hour (17 kw.) and will cool the oil to 55 deg. C. Fans and the oil pump are equipped with single-phase, capacitor-start, totally inclosed motors. The units come from the manufacturer completely assembled and are but little more expensive to install on the transformers than are conventional radiator units.

•

Spacers Reduce Bushing Maintenance

Possibilities of moisture entrance and of porcelain cracking, both of which may be causes of high-voltage bushing failure, can be largely avoided by a simple means used by a Southern power company. The upper and lower halves of the bushing are held together by a pair of collars bolted together and exerting pressure on a cork gasket. If the nuts on the bolts are pulled up unevenly the pressure on the cork gasket and on the flange of the porcelain tube is not equal all around. This may pinch the gasket and impair its quality as a seal and it may cause the porcelain to crack under the stresses of temperature changes.



The protection against this danger, as is shown in the sketch, is to put around each bolt between the collars a small spacer or washer of brass (S) of sufficient thickness to allow just so much and no more compression of the cork gasket and strain on the porcelain. Since adopting this device bushing failures attributable to uneven pressure between the holding rings have almost entirely stopped.

Nicopress

Enables You To Scratch

~~SPLICING TROUBLE~~

OFF YOUR WORRY SHEET

For Trouble-Free Splices on Distribution lines "Nicopress" rates A-1 and there's a reason, a number of reasons in fact—Because:—

- "Old timers" or "new timers" alike, agree that with Nicopress Sleeves and the convenient Nicopress Tool they will quickly make neat uniform splices, whether working on the poles or on the ground.
- The splices are so tight that the conductors cannot pull out and exceed in strength the rated breaking strength of the wire.
- Completed Nicopress Splices have a lasting high conductivity.
- In making the splice the wires go straight into the sleeve meeting end to end without distortion, bending or overlapping, this means the conservation of material and permits the splicing of broken line without changing the sag.
- All Nicopress power sleeves are bevelled at both ends which greatly facilitates pulling wire over the cross arms in the process of stringing and does away with snagging.
- Nicopress Reducing Sleeves provide for the splicing of wires of different sizes.

Order Nicopress from your jobber today and eliminate trouble at the line joints.

Nicopress Sleeves Are Available for...

COPPER ....
COPPERWELD ..
and
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} CONDUCTORS—SOLID OR STRANDED

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Manufacturer of Specialties for Power and Communication Lines

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Export Distributor INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

LOAD SERVICING

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Anti-Sabotage Under Dock Lighting

Very little information, if any, has been available on the subject of under-dock lighting for protection against sabotage where the dock or wharf is patrolled from the water side. At the request of Lieut. D. T. Adams of the Coast Guard Service, the lighting specialists of the Puget Sound Power & Light Company, Seattle, recently made some studies of the subject.

The usual lighting on the top side of the docks, together with improvised floodlighting, designed to improve seeing by the guards located on the dock, and that of industrial plants, warehouses and the like in the immediate vicinity makes so much direct and water-reflected glare in the eyes of the guards in boats who are trying to see under the docks that the effect is generally worse than no light at all.

With no previous data to work with, these specialists arrived at a solution through making trial installations under the three most common types of docks. These types are shown on the detail sketch and are: (1 and 2) the long pier jutting out at right angles to the shore line; (3) the wharf situated on the shore line and parallel to it; (4) the oil dock type where the main dock is parallel to the shore line but some distance from it and connected to the shore by one or more narrow docks at right angles.

Problems encountered in arriving at a solution were:

1. Shadows cast by uneven spacing of the piling give the effect of camouflaging the intruder.

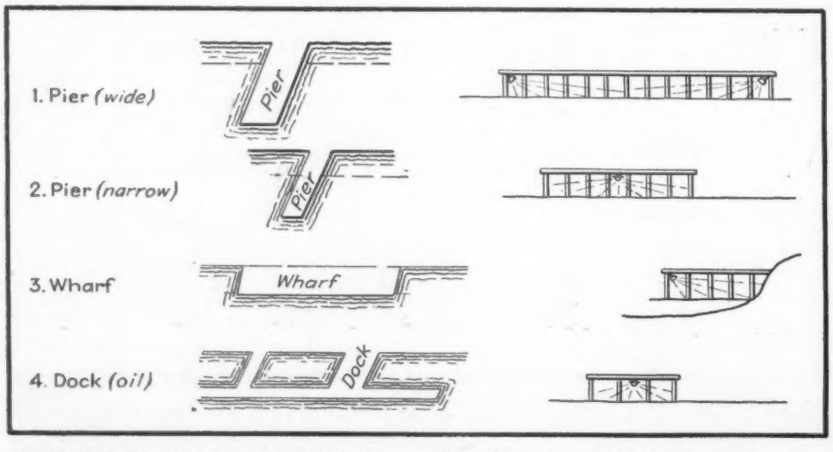
2. The changes in the tide have the effect of constantly changing the mounting height of the lights. These changes in height range from 4 ft. at high tide to 23 ft. at low tide.

3. Due to the large areas to be lighted and the fact that the lighting was to be installed for the duration only, it was necessary to design the lighting using a minimum amount of critical material and at a minimum expense.

4. Arrangements to be made with the electrical inspection department of the city to allow open wiring under docks except in cases of storage of highly explosive or inflammable materials.

The solutions that finally appeared on the drafting board originated from the deck of a Coast Guard patrol boat with lighting specialists Lloyd Smith, Paul Marble and Joe Flynn observing the results of several test installations.

The most effective under-dock lighting for the wide piers and wharfs was found to be PAR 38-150-watt projector spot lamps mounted on the outer edge with the beam directed back under the pier or wharf. The narrow pier and the oil docks were best lighted by the use of a single row of lamps down the center using the regular RLM type fixture. Explosion-proof units were required on all oil docks. The different docks and methods of lighting are shown on the detail drawing.



BASIC METHODS of under-dock lighting. 1. For wide piers, projector type units along each side. 2. For narrow piers, RLM units at center line. 3. Wharfs, projectors directed shoreward. Oil docks, explosion-proof units along center

•

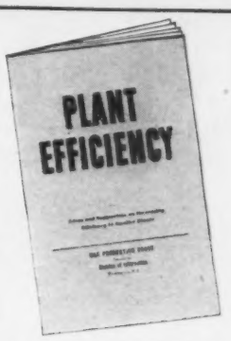
Electric Heat Speeds Product Washing

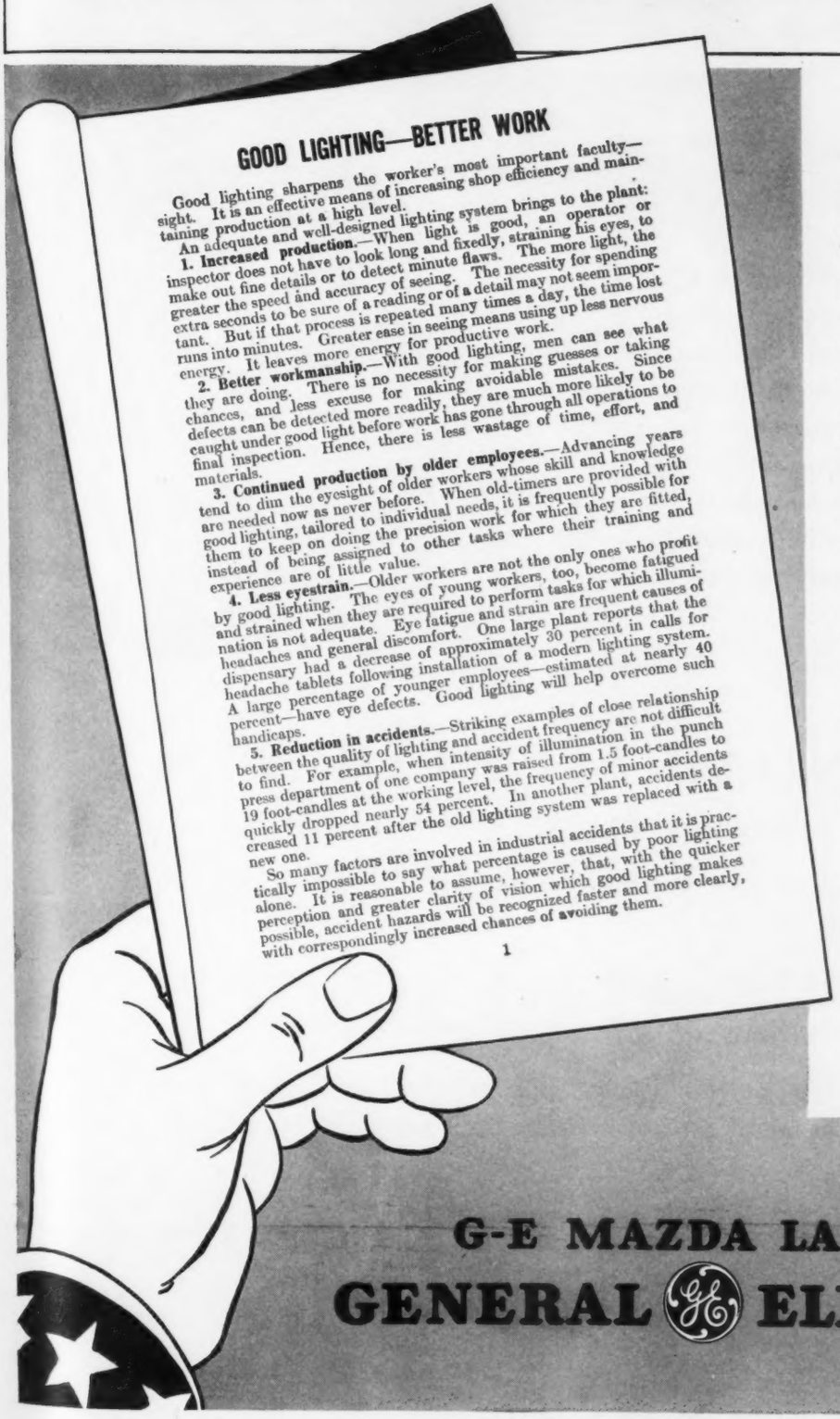
A Calrod heater installed in a second-hand washing machine at the Koch Manufacturing Company of Louisville, Ky., is accelerating the output of a small metal specialty made by this company.

After the piece has gone through the manufacturing process it is cleaned in a liquid soap solution heated to 190 deg. F. Formerly the solution was heated in a tank by gas, but much valuable production time was being wasted because of the time required to bring the solution up to the proper temperature.

To hurry the heating of the soap solution, Louis A. Koch, owner of the Koch Company, devised what he called a "jiffy" cleaner. Consisting simply of a G.E. 5,000-watt, 230-volt

HAVE YOU SEEN THIS NEW BOOK PUBLISHED BY THE WAR PRODUCTION BOARD?





GOOD LIGHTING—BETTER WORK

Good lighting sharpens the worker's most important faculty—sight. It is an effective means of increasing shop efficiency and maintaining production at a high level.

An adequate and well-designed lighting system brings to the plant:

1. Increased production.—When light is good, an operator or inspector does not have to look long and fixedly, straining his eyes, to make out fine details or to detect minute flaws. The more light, the greater the speed and accuracy of seeing. The necessity for spending extra seconds to be sure of a reading or of a detail may not seem important. But if that process is repeated many times a day, the time lost runs into minutes. Greater ease in seeing means using up less nervous energy. It leaves more energy for productive work.

2. Better workmanship.—With good lighting, men can see what they are doing. There is no necessity for making guesses or taking chances, and less excuse for making avoidable mistakes. Since defects can be detected more readily, they are much more likely to be caught under good light before work has gone through all operations to final inspection. Hence, there is less wastage of time, effort, and materials.

3. Continued production by older employees.—Advancing years tend to dim the eyesight of older workers whose skill and knowledge are needed now as never before. When old-timers are provided with good lighting, tailored to individual needs, it is frequently possible for them to keep on doing the precision work for which they are fitted, instead of being assigned to other tasks where their training and experience are of little value.

4. Less eyestrain.—Older workers are not the only ones who profit by good lighting. The eyes of young workers, too, become fatigued and strained when they are required to perform tasks for which illumination is not adequate. Eye fatigue and strain are frequent causes of headaches and general discomfort. One large plant reports that the dispensary had a decrease of approximately 30 percent in calls for headache tablets following installation of a modern lighting system. A large percentage of younger employees—estimated at nearly 40 percent—have eye defects. Good lighting will help overcome such handicaps.

5. Reduction in accidents.—Striking examples of close relationship between the quality of lighting and accident frequency are not difficult to find. For example, when intensity of illumination in the punch press department of one company was raised from 1.5 foot-candles to 19 foot-candles at the working level, the frequency of minor accidents quickly dropped nearly 54 percent. In another plant, accidents decreased 11 percent after the old lighting system was replaced with a new one.

So many factors are involved in industrial accidents that it is practically impossible to say what percentage is caused by poor lighting alone. It is reasonable to assume, however, that, with the quicker perception and greater clarity of vision which good lighting makes possible, accident hazards will be recognized faster and more clearly, with correspondingly increased chances of avoiding them.

1

EVERY war plant in your territory should have a copy of this new 39-page booklet on Plant Efficiency, published by the War Production Board. The WPB is anxious to give it as wide distribution as possible—and you can help!

It covers such important production problems as, adapting old machines to new jobs, maintenance and repair, worker training, plant protection, getting into war work, etc. And naturally lighting is given an important place as it is vitally important to precision work.

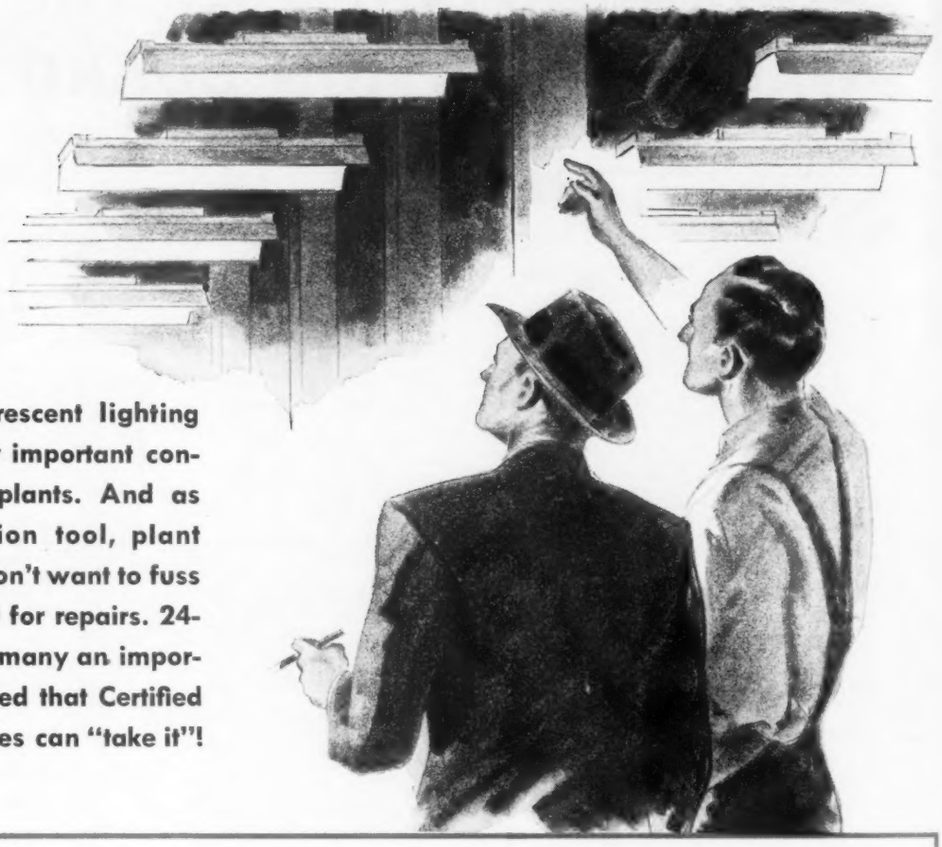
We suggest you contact your local WPB office without delay to get copies for your industrial customers. If they've run out, write War Production Board, Washington, D.C.

The General Electric Company, through our staff of lighting engineers, is glad to cooperate with you to help your customers speed war production with better lighting. General Electric Company, Nela Park, Cleveland, O.

G-E MAZDA LAMPS

GENERAL ELECTRIC

FLEUR-O-LIERS



The matter of fluorescent lighting fixtures is a mighty important consideration in war plants. And as with any production tool, plant maintenance men don't want to fuss with costly time out for repairs. 24-hours-a-day use in many an important plant has proved that Certified FLEUR-O-LIER fixtures can "take it"!

DEPENDABILITY COUNTS!

See why it pays to specify FLEUR-O-LIERS

- **Certified starters and ballasts . . .** assuring balanced operation —high power factor.
- **Durability and Safety . . .** electrically and structurally sound.
- **Ease of Maintenance . . .** easy to clean and re-lamp.
- **Maximum light output . . .** Certified control equipment plus high reflection factor assures efficient light from the lamps.
- **Flicker correction . . .** on circuits of two lamps or more.
- **Correct ventilation . . .** no danger of overheating in control unit.
- Every unit carries the FLEUR-O-LIER Manufacturers' Guarantee.

set new Standards of
PERFORMANCE AND SERVICE

Fixtures bearing this FLEUR-O-LIER label assure your customers maximum use of their lamps—plus electrical and mechanical dependability. That's important these days when every minute counts—and equipment must stand up!

And here's the reason. Though nearly 50 independent fixture manufacturers make FLEUR-O-LIERS, they all make them to 50 definite specifications set up by the makers of Mazda lamps. And FLEUR-O-LIERS meet these specifications as tested and certified by impartial Electrical Testing Laboratories.

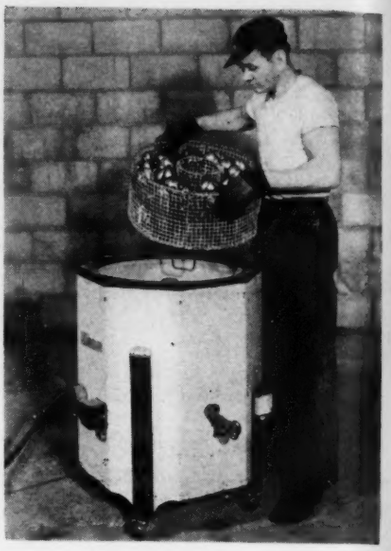
Important: Ballasts and starters have more to do with the satisfactory performance of fluorescent lamps than any other part of the fixture. Because *every* FLEUR-O-LIER fixture has Certified ballasts and starters, you can assure your customers of these advantages: longer lamp life—greater lighting efficiency—full use of the wiring system through high power factor ballasts—long life and dependable service from the units themselves!

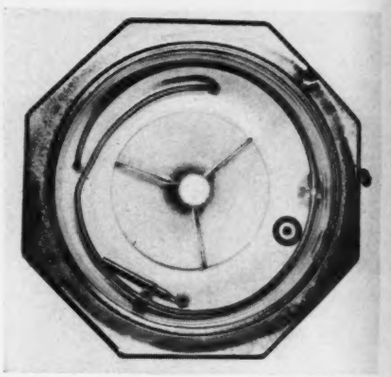
A vital tool in wartime production, fluorescent fixtures now require a suitable WPB priority rating. Any of the FLEUR-O-LIER Manufacturers will be glad to work with you on this to get the best lighting possible. Fleur-O-Lier Manufacturers, 2126-9 Keith Building, Cleveland, Ohio.

FLEUR·O·LIERS
CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements.

Everlasting
Fastenings
BRASS
BRONZE
COPPER
EVERDUR
MONEL
STAINLESS
Harper's Fastenings are fighting the Axis and fighting corrosion. They are being used on a multiplicity of war equipment . . . such as ships, planes, guns and tanks . . . because they successfully defy rust, corrosion and other tough conditions. Practically speaking, they are "Everlasting."
4320 STOCK ITEMS
. . . of bolts, nuts, screws, washers, rivets, and accessories in the non-ferrous and stainless alloys. Many are "hard-to-get." Specials manufactured to order. 4-color illustrated catalog free to executives.
The H. M. HARPER COMPANY, 2611 Fletcher St., Chicago; 45 W. Broadway, New York City.
HARPER Chicago
EVERLASTING FASTENINGS





General Electric Co.

SECOND-HAND washing machine equipped with electric heater, detail below, cleans metal parts

Calrod heater looped around the bottom of the washing machine, the "jiffy" cleaner brings the solution to the proper temperature eight to ten times faster than by the old method and has resulted in cooler working conditions, more accurate control of heat and more economical operation. The parts to be cleaned are placed in the machine in a special wire rack so that they will not strike the agitator or come in contact with the heater.

•

Effect of Light on Egg Production

Tests made last fall and winter on three lots of 100 hens each, show that egg production is practically in direct proportion to hours of light, according to a report published by the Southern California Edison Company. The tests were made at the demonstration farm of the Los Angeles County Live Stock Department

Like sentinels they stand, these sturdy structures of steel that support America's super-highways of electric power. Yet their strength is such that the forces of storm and flood and frost leave them untouched. They are built for stresses such as they will probably never be called upon to meet. It is this dependable sturdiness—also reflected in low maintenance cost—that makes Blaw-Knox transmission towers so well-liked by operating engineers. Into them go highly specialized skills in designing, fabricating and galvanizing. Blaw-Knox can be of inestimable help to anyone with a power transmission problem. A discussion is invited.

BLAW-KNOX TRANSMISSION TOWERS

W-KNOX DIVISION OF BLAW-KNOX COMPANY 2013 FARMERS BANK BUILDING, PITTSBURGH, PA.
NEW YORK • CHICAGO • PHILADELPHIA • BIRMINGHAM

It is no coincidence that the Army, Navy, large Power and Telephone Companies alike specify Cope Tools and Equipment. They demand the best and have confidence in our ability to serve them.

WRITE FOR CATALOG

T. J. COPE, INC.
6120-6122 VINE STREET
PHILADELPHIA, PA.

Effect of Light on Egg Production

	Total Four Months Egg Production	Average Total Egg Production Per Hen
All-Night Lights ...	4,699	47.99
Morning Lights	3,401	34.47
No Lights	1,948	19.52

near Pomona, in cooperation with the University of California Extension Service and the U. S. Department of Agriculture.

All-night lighting was used with one lot of hens, with another, lighting from 3 a.m. to daylight and no artificial lighting with the third. The table shows the results of the tests. Additional to the improved egg production, there was an observable increase in the weight of the hens, making them more profitable in the poultry market. Although all-night lighting showed the highest returns in eggs, those in charge of the experiment recommended morning lighting as best for birds to be retained for another laying year. They regard the long hours of lighting as good for hens in second year moult destined for marketing.

•

Servicing Becomes Sales Nucleus

Concentration upon appliance servicing and the merchandising of items still marketable under governmental regulations feature Connecticut Light & Power store activities at this time, but William M. Walsh, merchandising manager, states that attention is also being given to the conditions under which local electrical dealers and service outlets can function, since the utility company can handle only a small proportion of service calls on appliance equipment. The departmental personnel has decreased from nearly 200 to less than 70 persons since 1941. All of these have not left the company; several have been transferred to other assignments; some are in military service and others in war industries. The volume of appliance sales is 31.9 percent below the first half of 1941, and is expected to go lower for the year as a whole. The company has a substantial inventory of certain appliances, but most of the items cannot be released without a priority rating.

Although no cooking schools are being run by the company, every effort is being made to co-operate with local agencies in conducting nutrition classes. This work is contributory to the war effort in the civilian field, since it helps to bring about more effective use of food materials and of energy for their preparation for consumption. In place of the former type of advertising to promote load building through the sale of merchandise the company features copy to encourage customers to take care of their present equipment. The company is doing its best to aid dealers in handling repair work and to lay a foundation for post-war activities. Under limitations of reduced personnel vigorous efforts to maintain customer contacts by all employees are being furthered.

•

Brings Sellers and Buyers Together

WANT TO BUY OR SELL A USED *Electric Refrigerator?*

Maybe We Can Help!

A NEW SERVICE FOR OUR CUSTOMERS

Because of the scarcity of new and used electric refrigerators, brought on by the war, we believe it will be a genuinely helpful service if we serve as an "information center" on used electric refrigerators. With this in mind, we announce a new, free service to our customers—

Each of our stores will maintain a list of used electric refrigerators available from individuals and a list of those desiring to buy.

Assisting buyers and sellers in locating each other, will be the extent of our service. We cannot undertake to buy or sell the refrigerators, or to act as agent for their sale or purchase. We will assume no obligation nor charge any fee or commission.

WHAT TO DO ABOUT IT

IF YOU WANT TO SELL a used electric refrigerator—call our office and ask to have it put on the list of "refrigerators available." Please be prepared to furnish the manufacturer's name, the model number, age, size, condition, and the price you want.

When someone inquires about the purchase of a used electric refrigerator like or similar to yours, we will put them in touch with you directly.

IF YOU WANT TO BUY a used electric refrigerator—call our office and if we can't immediately put you in touch with someone who has approximately what you want, we will add your name to the list of "refrigerators wanted" and notify you when one is available. Please be prepared to tell us approximately the size you want, and the price you wish to pay.

We want to help. Simply call our nearest office to avail yourself of this free service.

GEORGIA POWER COMPANY
A CITIZEN WHEREVER WE SERVE

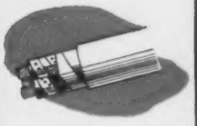
UTILITY acts as non-profit middleman in sales of used appliances

(Another in the series of advertisements demonstrating the thoroughness of Anaconda research in electrical wire and cables.)

Exclusive paper-tension device developed by Anaconda for controlling tension on tapes during application.

Patented Taylor vacuum-pressure impregnation is used only by Anaconda.

Acceptance tests on paper cable, part of Anaconda quality control.



Anaconda Paper Cable is pre-empted for the toughest war jobs in industry, shipyards, and wherever its properties can serve best.

Low power factor in paper cable now begins *in America's Forests*

Six years ago, on hunch or foresight, a group of Anaconda engineers, returning from a visit to European mills, decided that America's sources for insulating paper should be developed...despite the accepted preference for Swedish wood pulp. Anaconda engineers working closely with domestic mills developed an insulating cable from domestic wood pulp *superior to that made with Swedish pulp.* As a result of this and many other new findings, Anaconda engineers have steadily decreased the power factor in Anaconda paper cable. As a matter of fact, today the power factor vs. temperature curve is practically horizontal.

For information about this construction, just write us saying "Send me your paper cable literature". 42245

Two marks of achievement—The cherished Navy "E" awarded to two plants for achievement in production...the Anaconda trademark for achievement in quality.

ELECTRICAL WIRES AND CABLES OF COPPER ARE THE LIFE LINES OF OUR NATION

ANACONDA WIRE & CABLE COMPANY

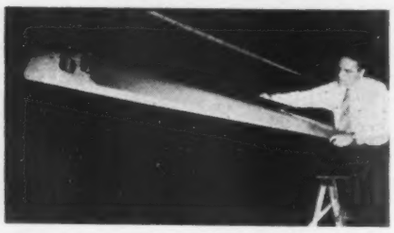
Subsidiary of Anaconda Copper Mining Company

GENERAL OFFICES: 25 Broadway, New York City • CHICAGO OFFICE: 20 North Wacker Drive • Sales Offices in Principal Cities

NEW EQUIPMENT

Fluorescent Lamp, Ballast

Recently patented ballast for new "sequence-starting circuit" is employed for four lamps, replacing two ballasts previously required. The two lamps on each phase start in sequence and operate in series. Claimed for the new assembly are 50 percent reductions in use of critical materials and in cost of the ballast, a 20 percent reduction in over-all fixture cost, an 8 percent increase in light output, a marked reduction in weight of fixture.

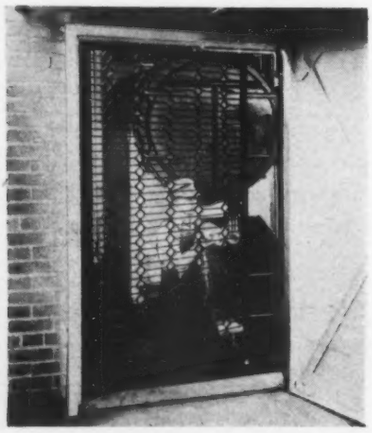


Fixture comprised of four 100-watt tubes and a single ballast unit, 254, 265 and 277 volts. **General Electric Co.**, Nela Park, Cleveland, Ohio.

•

Protective Grille

New swinging-type grille, permanently installed by massive side hinges, an economical way of barricading doorways without obstructing air, light or vision. It is furnished in any size and is of a design suited to any style of structure. Cylinder lock provided.



Swinging grill. **Kinnear Manufacturing Co.**, Columbus, Ohio.

Voltage Regulator

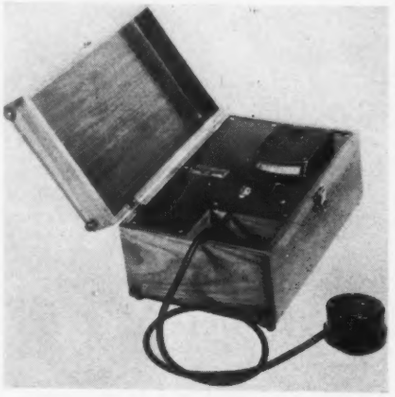
Type SA air-cooled induction voltage-regulator for indoor service. **Westinghouse Electric & Manufacturing Co.**, East Pittsburgh, Pa.

Sizes available for 2400-volt, 50 to 300-amp. feeders or for 4,800-volt feeders, 15 to 150 amp. Completely equipped and self-contained with built-in control panel mounting, improved voltage-regulating relay, line drop compensator and manual control. Chimney draft effect for natural circulation of cooling air.

•

Reflection Meters

New photoelectric reflection meters, designed for measuring reflectance and color of solid surfaces, fabrics, pastes, powders and opaque liquids, are provided with a surface "search unit," so that the test specimen need not be inserted into the instrument. "Model 600" is operated from two dry-cell batteries which are housed in the instrument casing. "Model 610" is operated on 105-130-volt, 50-60-cycle alternating current.

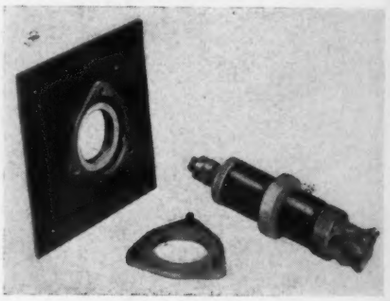


"Model 600," shown, operated from dry-cell batteries. **Photovolt Corp.**, 95 Madison Avenue, New York, N. Y.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Bushing Clamp

New clamping device for locking the low-voltage bushing securely to the side of the distribution transformer tank is welded to the tank wall and forms a recess for fitting the shoulder of the bushing and the cork gasket, which is completely inclosed and protected from the weather. A second cork gasket forms a cushion between the top of the porcelain shoulder and the second metal clamp. The two clamps are tightened together by three bronze alloy screws.



"Stationary bushing clamp." **Pennsylvania Transformer Co.**, 808 Ridge Avenue, North Side, Pittsburgh, Pa.

•

Welding Electrode

"Fleetweld 11;" created expressly for use with the "Fleet-Fillet" technique of arc welding. **The Lincoln Electric Co.**, Cleveland, Ohio.

New welding electrode is fast flowing and gives deep penetration of metal into the root of the joint. It is of shielded arc type and heavily coated to exclude oxides and nitrides from the weld. Designed to complete a weld in one pass, this electrode is made in 18-in. lengths and two diameters, $\frac{3}{16}$-in. and $\frac{1}{4}$-in., and packed in 50-lb. cans.

•

Relay

"Type DJ-1" relay; for automatic and supervisory control. **Control Corp.**, Minneapolis, Minn.

Mechanical-latching, double-coil relay with the features that coil is energized only momentarily and that armature must pass over dead center and contacts must be always in one or the other position, no intermediate position possible. Available mounted on 12-point plug or for single stud mounting.

SILHOUETTES
in the night

Two silhouettes against the glowing sky, so similar in appearance and purpose, yet so vastly different in character.

The one is a factory, with chimneys belching smoke and fire, evidence of the productive energy beneath, working night and day to feed the cannons of our fighters.

Much more difficult a task, with many lives held in the balance, is that of the men behind the gun. Every flash, every rumble echoes a unity of purpose supported by the greatest single group in the history of the world. One object! Simply stated, but of colossal import. "Win the war!"

Two silhouettes against the sky. One is a symbol of the country's productive effort of which you and we are a part. We are pleased to place our facilities completely at the disposal of our government. We are proud that it is in our power to help the boys whose forms are outlined in that other silhouette.

"HANG THE LOAD ON HUBBARD HARDWARE"

HUBBARD AND COMPANY

PITTSBURGH OAKLAND CALIFORNIA CHICAGO

"LUBRI-TACT" PORCELAIN TUBE RHEOSTATS

"JAGABI" RHEOSTATS
. . . for ACCURATE Current Control

Jagabi Rheostats combine ruggedness of construction with instrument accuracy. From the smallest to the largest size, they permit the fine adjustment that is necessary for the proper control or functioning of equipment with which they are used.

Jagabi Lubri-tact Rheostats have a unique lubricated positive sliding contact and are made in four sizes and seventy-six ratings. Available also with screw adjustment and in metal-cage types for switchboard or table mounting.

Jagabi Compression Carbon Rheostats can be smoothly controlled by screw adjustment and overloads of several hundred percent are permissible for short periods of time. Four sizes in current ratings from 6 to 65 amps. up to 55 to 800 amps.

For descriptive material and data write for Rheostat Bulletin 1705-W.

JAMES G. BIDDLE CO.
1211-13 ARCH STREET · PHILADELPHIA, PA.

"JAGABI" COMPRESSION CARBON RHEOSTATS

TECHNICAL LITERATURE

MORE STEAMING CAPACITY—An 8-page folder featuring the importance of steam plant recording instruments and combustion control, notably in relation to utilization of new and less experienced operators. Sources of loss and trouble areas are briefly covered, and a useful diagram of theoretical air required for the combustion of different coals is included. Obtainable under title of "How to Safely Stretch Steaming Capacity" (No. 5 of a series) from Bailey Meter Co., 1,070 Ivanhoe Road, Cleveland, Ohio, and Bailey Meter Company, Ltd., Montreal, Canada.

BALLASTS—A new bulletin, 421-FL, on single, two-lamp and three-lamp ballasts for fluorescent lamps, with specifications and wiring diagrams; twelve pages total. A page of service suggestions for fluorescent lamps with diagnoses of operating troubles and a tabulation of lamp dimensions and electrical data applying to various sizes and ratings are included. Available from Jefferson Electric Co., Bellwood (Chicago suburb), Ill.

WELDING TERMS—Standard definitions of welding terms, explained where necessary by diagram, well classified and indexed and amplified by a master chart of welding processes have been published at 40 cents per copy by American Welding Society, 33 West 39th Street, New York, N. Y.

TRANSFORMERS—New 24-page booklet (Descriptive Data 46-100) on Type CSP distribution transformers with "Hipersil" cores, containing charts on voltage regulation, short-time overload capacity, extra loading area gained with operation by copper temperature, circuit diagrams, co-ordination of links with circuit breaker, and outline of tests for lightning protection. Three-point protection of insulation with "De-ion" gaps shown. Available from Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

CONDUCTIVITY OF CO_2 SNOW—Snow and gas discharged from two makes of first aid CO_2 extinguishers are found non-conductive, but caution should be exercised in bringing dirty or wet horns too close to live equipment. Tests and data in Bulletin of Research (No. 26, July, 1942) of Underwriters' Laboratories, Inc., Chicago, Ill.

OFFICE ECONOMIES—Practical hints on how to save office supplies, conserve lighting and telephone calls and to keep typewriters in first-class condition are covered in a 12-page pocket-size booklet, E 6,222, "It's The Little Things That Count," available from offices of Allis-Chalmers Manufacturing Co., Milwaukee, Wis., and elsewhere.

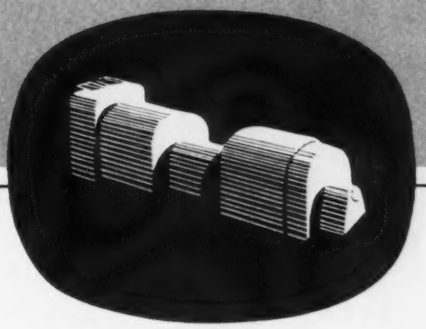
WELD TESTS—"Standard Methods for the Mechanical Testing of Welds" contains diagrammatic discussion of tests for density, soundness, tensile, shearing and bend tests and a section on etching reagents and procedure. Available at 40 cents from American Welding Society, 33 West 39th St., New York, N. Y.

SPECIFICATIONS, foot-candle data, coefficients of utilization charts, equipment spacing and other information essential for ordering and installing fluorescent and incandescent lighting in industrial, office and commercial establishments is included in the new 88-page catalog 42 of Curtis Lighting, Inc., 6135 W. 65th St., Chicago, Ill.

GULFCREST OIL

is ALCHLOR PROCESSED—

Your assurance that it provides better turbine protection!



Gulf's Alchlor Process is the most effective method known for removing impurities and unstable hydrocarbons from oil.

YOU are sure of better protection for your turbines when you put Gulfcrest Oil in service. For this highest quality lubricating oil is not only refined by conventional methods, but is super-refined by the Gulf Alchlor Process, the most effective method yet known for removing impurities and unstable hydrocarbons from oil—the undesirable constituents which cause oxidation and gum and sludge formation.

After years of service, Gulfcrest Oil shows so little evidence of deterioration that users report it is in substantially as good condition as when first put into the turbine lubricating system. Gulfcrest Oil is the world's finest oil for turbine lubrication!

Send the coupon below for the story of Gulfcrest Oil and what it can do for you—no obligation, of course.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company E.W.
3800 Gulf Building, Pittsburgh, Pa.

Please send me my copy—no charge—of the brochure "Gulfcrest Turbine Oil."

Name _____

Company _____

Address _____

A MEAT PACKER

....by Reducing

...“STICK” IN OUR TANKAGE DRYERS BLEW FUSES—we changed to BUSS fuses —production losses were eliminated.
“We have several Tankage Dryers, operated by 35, 40 and 50 H.P. 220 volt, 60 cycle motors. When a mix used in these dryers known as “Stick” is added, there is a temporary overload present which, while of a harmless nature, caused shutdowns due to the blowing of fuses. Such outages were occurring at the rate of twice daily on each circuit.
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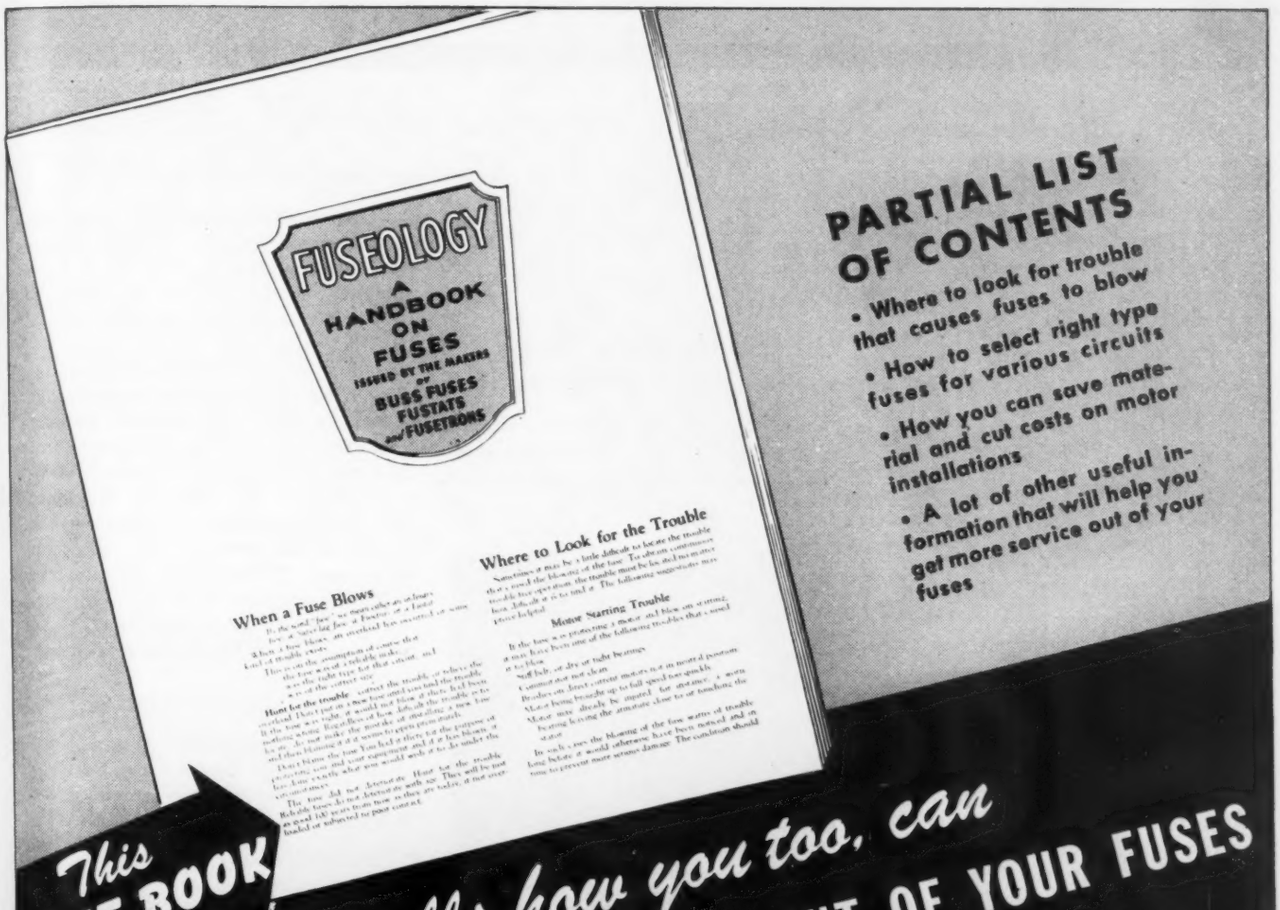
FUSE
BUSS Super-Lag

INCREASED OUTPUT ELECTRICAL OUTAGES


FUSEOLOGY
A HANDBOOK ON FUSES
ISSUED BY THE MAKERS OF BUSS FUSES FUSTATS and FUSETRONS
When a Fuse Blows
Where to Look for the Trouble
Motor Starting Trouble

PARTIAL LIST OF CONTENTS

- Where to look for trouble that causes fuses to blow
- How to select right type fuses for various circuits
- How you can save material and cut costs on motor installations
- A lot of other useful information that will help you get more service out of your fuses

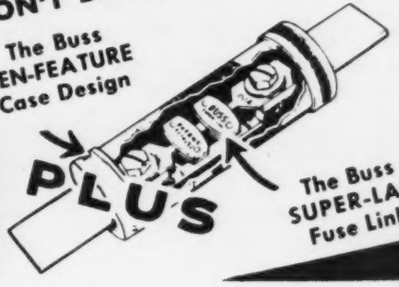
This **FREE BOOK** *. . . tells how you too, can*

GET MORE "MILEAGE" OUT OF YOUR FUSES

SAVE FUSES *Send for your Copy*

WHY BUSS FUSES DON'T BLOW NEEDLESSLY

The Buss TEN-FEATURE Case Design



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NEWS ABOUT PEOPLE

Seattle Utility Names New District Managers

Changes in the management of the Puget Sound Power & Light Co. offices have been recently announced. Andy Loft, formerly connected with the Bellingham office, has been transferred to Mount Vernon as manager. Walter R. Chitty, for the past four years manager in Snohomish, has been assigned to the managership in Edmonds and Frank Ballard, formerly dealer representative out of Everett, has been appointed manager in Snohomish to succeed Mr. Chitty. Mr. Chitty joined the Puget Power Company in 1922 and Mr. Ballard in 1928.

Charles McGarrigle, for the past seven years manager of the Snoqualmie office, has been transferred to Renton as suburban service supervisor. He is succeeded at Snoqualmie by Verne Burmester. Mr. McGarrigle started with the company in 1923 as a meter reader. Mr. Burmester became identified with the Puget Sound utility in 1929. Harry Miller, formerly connected with the Edmonds office, has been appointed manager at Monroe. He joined the company in 1924 as a lineman.

•

▶ T. J. Higgins, assistant professor, department of electrical engineering, Tulane University, New Orleans, La., has been appointed associate professor in the department of electrical engineering, Illinois Institute of Technology, Chicago.

▶ E. W. Ritter, recently appointed as assistant to G. W. Cole, president of the Corning Glass Works, has been called to Washington for work in connection with the U. S. Signal Corps. Mr. Ritter, who, before his connection with Corning, was vice-president of R.C.A., has had extensive experience in engineering, manufacturing, and research, related to communication problems. His special assignment at Washington will require about three months, at the expiration of which he will return to his duties at Corning. He began his association with Corning Glass Works in June of this year.

•

Cleveland Utility Elects Lindseth Vice-President

Elmer L. Lindseth has been elected a vice-president of the Cleveland Electric Illuminating Co. Mr. Lindseth has been associated with the company con-

tinuously since his graduation from Yale University in 1926, except for one year when he was connected with the North American Co. in New York. He has been a production engineer and assistant to the president of the Cleveland utility.

Mr. Lindseth is a mechanical engineer, having received his technical education at Miami University, the Case School of Applied Science and Yale University.

•

▶ E. W. Kimbark, associate professor and acting chairman of the electrical engineering department, Northwestern University, Evanston, Ill., is on leave of absence at Massachusetts Institute of Technology, teaching special courses for Army and Navy officers.

▶ Clinton H. Sawyer, Jr., has been appointed supervisor (acting), industrial sales, in charge of the Main Line and Delaware Divisions of the Philadelphia Electric Co., to succeed Milton I. Allen, who has recently been assigned new duties. Following graduation from the Harvard engineering school in 1923, Mr. Sawyer became identified with the General Electric Co. Two years later he joined Stone & Webster and spent the following five years with that organization in power sales, personnel and security sales activities. He joined Philadelphia Electric in 1931, as industrial serviceman. He was senior industrial salesman when he was selected for this latest appointment.

▶ Joseph Clark, assistant engineer, electrical engineering department, Consolidated Edison Co. of New York, is on leave of absence, now serving with Jackson & Moreland, Boston, Mass.

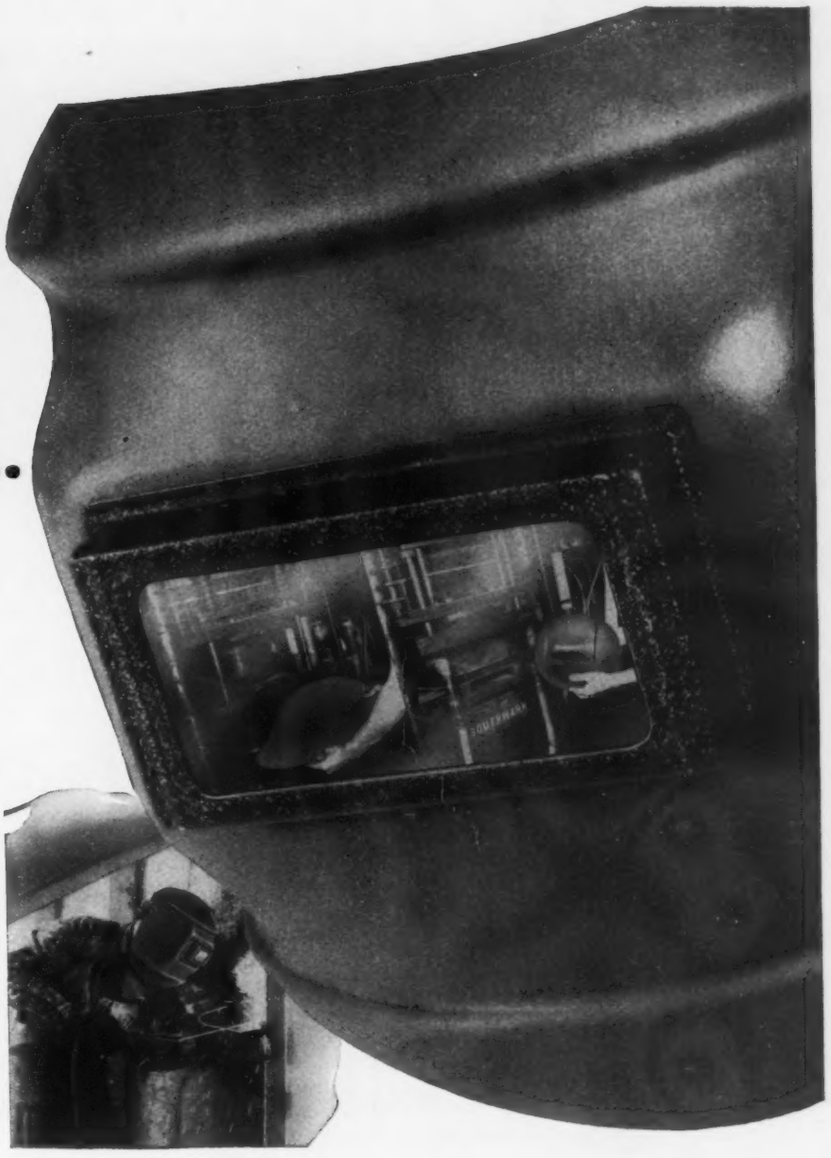
▶ Charles H. Lahr, secretary of Ohio Edison Co. and its predecessor companies since 1917, was the guest of honor at a dinner and outing on September 5 attended by a group of 100 of his fellow employees. The occasion was in commemoration of his completion of 50 years of service with the company. Presentation of a gold watch, the gift of those present, was made by A. C. Blinn, president of the company. L. G. Tighe, vice-president and Akron division manager of the utility, was toastmaster.

▶ Warren H. Marple has been appointed manager of the Lower Columbia district office of the Bonneville Power Administration, with headquarters in Portland. The district office which Mr. Marple will manage is in charge of all business negotiations and contacts with power applicants and customers, conducting power contract negotiations and advising customers in

TIME WAS...

When a mask was used only as a guise for lurking danger.

☆



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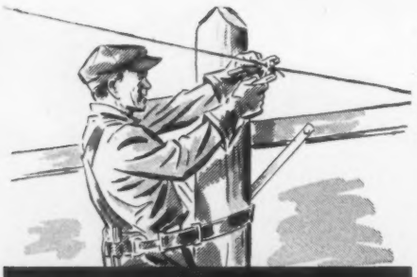
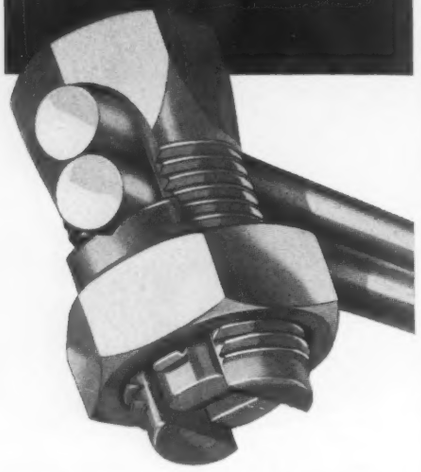


L-M connectors are *really* re-usable



When we say L-M Connectors are re-usable we mean that after being used for long periods of time at high contact pressures nuts move so freely on the threads that you can turn them with your fingers.

L-M Connectors provide high re-use value because of the careful machining of body and nut threads. This machining gives them the strength to withstand high pressure tightening without damage.

LINE MATERIAL CO.

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their operating and management problems in the Lower Columbia district. Mr. Marple has been assistant to W. A. Dittmer, chief of the Bonneville system planning and marketing division since 1939. Before joining the Bonneville staff he was identified with the Illinois Commerce Commission, where he served for six years as statistician, assistant to executive officer and administrative assistant to the chairman. He was power examiner on the Federal Trade Commission at Washington, D. C., in 1929 and 1930.

▶ EDGAR W. MORGAN, assistant superintendent of distribution, Madison Gas & Electric Co., Madison, Wis., is now connected with E. I. du Pont de Nemours & Co. at Morgantown, W. Va.

▶ MILTON I. ALLEN has been appointed manager (acting), sales service division of the Philadelphia Electric Co., to succeed Morison Blake, now on military leave. Mr. Allen was graduated from Pennsylvania State College as an electrical engineer in 1927 and took the Westinghouse student graduate course before joining the Philadelphia utility in 1928 as an industrial serviceman. His entire service with Philadelphia Electric has been in the industrial sales department. Following several years' experience as power salesman, he was named director of industrial sales, Main Line and Delaware Divisions.

▶ H. K. HINES, district manager of the Frankfort, Ky., properties of Tri-City Utilities Corp., will be elected president and a director of that organization, formerly known as the Kentucky-Tennessee Light & Power Co. As chief executive of the company, Mr. Hines will succeed R. H. Ferguson, who recently resigned.

▶ R. L. COLE has been appointed electric superintendent of the western division of the Philadelphia Electric Co. Mr. Cole has been in the employ of the company since 1935, when he was graduated from the University of Pennsylvania as an electrical engineer. Entering the service as a cadet, he was subsequently named engineering assistant at Morton and later at Coatesville. In 1941 he was made appliance service superintendent at Norristown. Later he was transferred to the staff of the general superintendent's office, transmission and distribution department, at Philadelphia, thence moving to the overhead lines division as an engineer.

▶ LOUIS A. GOALBY, sales engineer, has been appointed manager of the Denver, Colo., office of the Westinghouse Electric & Manufacturing Co. Mr. Goalby has been located in the Denver office as an apparatus salesman since 1936. He

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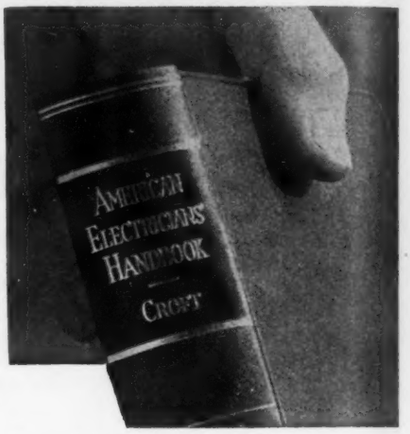

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Today, wherever the new AmerTran products are being installed in connection with the war effort, electrical men are realizing that AmerTran is producing transformers that are *new*—new in electrical design, new in mechanical features, new in efficiency and economy.

True, we have placed entirely at the disposal of the Government and customers with high priorities our new and greater plant capacity. But, as for the past 41 years, we are still glad to extend to you, without obligation, the advice of AmerTran Engineers to help you secure the best results from your present equipment, to help solve today's problems of operation and maintenance, and to plan for your future needs in transformers for all utility and industrial applications.

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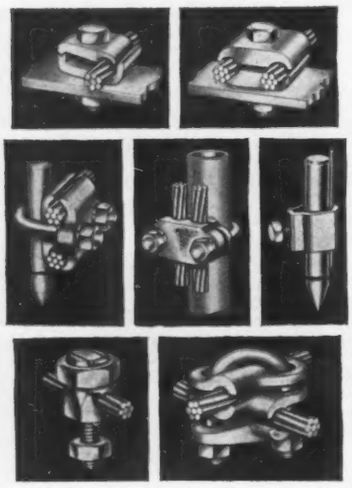

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has been affiliated with Westinghouse since 1917. After various assignments in apparatus sales, Mr. Goalby joined the Westinghouse Lamp Co. in 1933. He returned to the parent company as a member of the Denver office staff three years later.

•

Wheelco Announces New Sales Appointments

Three appointments have recently been made to the sales and service organization of the Wheelco Instruments Co., Chicago.

C. L. Clark, who has been connected with the Westinghouse Electric & Manufacturing Co. for the past thirteen years, recently as control specialist at the Cincinnati office, has been assigned to the Cleveland office as sales engineer.

Robert N. Miller, for the past seven years sales and service engineer for Mercoid Corp. in Chicago, is now service engineer with the Wheelco Cleveland office. Howard B. Jones has become identified with the Chicago office in the capacity of sales and service engineer.

•

▶ LAFAYETTE C. REYNOLDS has been appointed to the recently created position of assistant to the president of Eureka Vacuum Cleaner Co., Detroit. Mr. Reynolds brings to his new position a long background of engineering and production experience gained through associations with several of the country's leading corporations, including the General Electric Co., New York Central R.R., General Vehicle Co., General Motors Corp., Elliott Fisher Co. and the American Writing Paper Co.

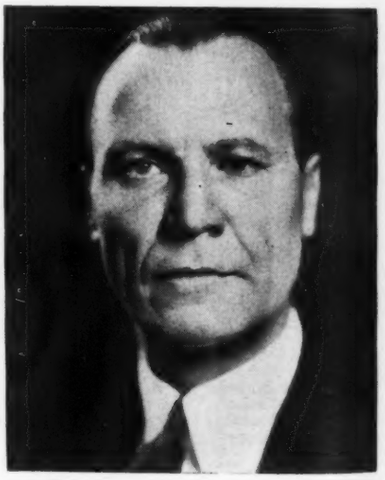
▶ R. E. POWERS, formerly of Chicago and New York, has been named Pacific Coast district manager of the manufacturing and repair department of the Westinghouse Electric & Manufacturing Co., according to an announcement by H. F. Boe, manager of the company's district manufacturing and repair organization. Mr. Powers goes to Emeryville, Cal., from Chicago, where he has been in charge of the Northwestern district for four years. A native of Davenport, Wash., Mr. Powers received an electrical engineering degree from Washington State College at Pullman, Wash., and, in 1923, joined the Westinghouse graduate student course at East Pittsburgh. He served in various capacities at East Pittsburgh and New York until 1936, when he was made manager of the engineering division, Eastern Division, at New York. During his engineering career Mr. Powers has been granted patents on various types of electrical apparatus, including transformers, generators, relays and reactors.

▶ WILLARD S. CRANDALL has been appointed director of engineering for the Fostoria Pressed Steel Corp., Fostoria, Ohio, to succeed Lieut. Ray N. Green, who entered the service of the armed forces last fall. Mr. Crandall's first connection with Fostoria was as western district manager. He later assumed the managership of the entire western division, the position he held until early this year, when he was called to take over product development activities at the factory. His early business experience included positions with Richmond Electric Co., General Electric Supply Corp. at Indianapolis and Westinghouse Electric Supply Corp. at Indianapolis.

OBITUARY

Alfred H. Schoellkopf

Alfred H. Schoellkopf, president of Niagara Hudson Power Corp., died in New York on September 9, after several months' illness. He was 49 years old.



Mr. Schoellkopf was the son of C. P. Hugo Schoellkopf and the grandson of Jacob F. Schoellkopf, pioneer of hydro-electric power development at Niagara Falls. He died within an hour of the death of his uncle, Jacob F. Schoellkopf, president of the investment firm of Schoellkopf, Hutton & Pomeroy and also identified with the hydro-electric development in the Niagara region.

Regarded as one of the outstanding public utility leaders of the country, Mr. Schoellkopf had been president of Niagara Hudson Power Corp. since 1933, and previously had been president of Buffalo, Niagara & Eastern Power

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Flexural Strength — Edgewise	16,000-20,000 lbs. per sq. in.
— Flatwise	16,000-20,000 lbs. per sq. in.
Impact Strength	0.6-0.8 ft. lbs. per in. of notch (Charpy or Izod)
Surface Hardness	104 Rockwell M 40 Brinell
Maximum Heat Resistance	80°C (176°F)
Moisture Absorption—24 Hour Immersion	
Thickness in Inches	
1/16	3.5%-4.5%
1/8	3.0%-4.0%
1/4	1.5%
1/2	0.70%
Dielectric Strength—Short Time Test	
Thickness in Inches	
1/16	700-900 volts per mil
1/8	550-700 volts per mil
1/4	500-700 volts per mil
Dielectric Strength—Step by Step Test	
Thickness in Inches	
1/16	450-650 volts per mil
1/8	550-600 volts per mil
1/4	350-500 volts per mil
Dielectric Constant	4.40
Power Factor	0.037
Loss Factor	0.162
Arc Resistance	183-188 Seconds

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Corp. since 1929. He had been associated with the Niagara Hudson System and its predecessor companies for the past 27 years.

He was first employed by the Niagara Falls Hydraulic Power & Manufacturing Co. in 1915 and became vice-president and director of the Niagara Falls Power Co. in 1920. When Buffalo, Niagara & Eastern Power Corp. was formed, in 1925, he became a director and vice-president of that corporation, serving as its general manager until 1929. From 1929 to 1933 he was president of Buffalo, Niagara & Eastern Power Corp., resigning in 1933 to become president of Niagara Hudson Power Corp. Mr. Schoellkopf was also chairman of the board of New York Power & Light Corp. and a director of several other Niagara Hudson System companies.

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Jacob F. Schoellkopf

Jacob F. Schoellkopf, prominently identified with the electric power, investment banking and aniline color industries, died on September 9 at his home in Lake View, a suburb of Buffalo, N. Y. He was 84 years old. At the time of his death he was chairman, president and a director of the investment firm of Schoellkopf, Hutton & Pomeroy of Buffalo, which he organized in 1919.

In 1880 Mr. Schoellkopf entered the aniline business in Buffalo, his company pioneering in making dyes in this country. During the first World War the Schoellkopf interests were merged with other companies to form the National Aniline and Chemical Co., Inc. Mr. Schoellkopf was named president, serving until 1918.

Mr. Schoellkopf became interested in the Hydraulic Power Co. at Niagara Falls as early as 1900. In 1917 the company was merged with Niagara Falls Power Co. and Mr. Schoellkopf became chairman of the board. Some years later the company became part of the Niagara Hudson Power Corp. system.

•

▶ William H. Brenner, retired engineer, Atlanta, Ga., died on June 20, in his eighty-second year. Mr. Brenner was employed in the engineering department of the New York Edison Co. from 1883 to 1886 and the following year he spent with the Edison Electric Illuminating Co., Cincinnati, as superintendent and electrician. He was engaged in electric light and railway construction in Tokyo, Japan, from 1887 to 1891, when he became district engineer for the Edison General Electric Co., Toronto, Ontario. Subsequent connections followed with the Montreal Street Railway, the Electrical and Mechanical Engineering Co., New York, N. Y., and the Electric Storage Battery Co., Philadelphia, with headquarters in New York. In 1896 he became construction engineer for the New York and Staten Island Electrical Co., Livingston, N. Y., and then returned to Japan, serving for three years as engineering manager for Frazer & Co. in Yokohama. From 1900 to 1909 he was managing director and chief engineer at the Zemma Works in Yokohama. Mr. Brenner was appointed manager of the British Columbia Manufacturing Co., New Westminster, in 1909 and two years later he joined the Electromotor Equipment Co., London, England, as managing director. He served as director, Gerente de la Fabrica Cia, Anglo-Espanola de Cemento Portland, Matillas, Spain, from 1913 to 1929 when he retired. Mr. Brenner was a member of the American Institute of Electrical Engineers and also of the American Society of Mechanical Engineers.

▶ William M. Francis, 73, since 1898 district manager for the Hartford Steam Boiler Inspection & Insurance Co., in Atlanta, Ga., died in that city on September 2. A native of Hartford, Mr. Francis had been the company's oldest employee in point of service.

▶ Mark D. Rowe, sales executive of the Permutit Company, New York, died in Paterson, N. J., on August 31, in his fifty-third year. A native of Philadelphia, Mr. Rowe was a graduate in mining engineering of Pennsylvania State College. He practiced his profession in Mexico and South America until 1917, when he became an executive of Servel, Inc. He became associated with the Permutit Company in 1936.

▶ Charles S. Zimmer, sales manager for the Bussmann Manufacturing Co., died at his home in Houston, Tex., on July 21. Mr. Zimmer was very active in the affairs of the International Association of Electrical Inspectors and was chairman of the membership committee for the Southern section. He was a member of the American Institute of Electrical Engineers.

▶ Arthur W. Adams, secretary-treasurer of Brazilian Traction, Light & Power Co., Ltd., died in Toronto on September 7. He was 57 years of age. Mr. Adams was a director of the Sao Paulo Tramway Light & Power Co., Ltd., the Sao Paulo Electric Co., Ltd.; Brazilian Hydro-Electric Co., Ltd.; Brazilian Telephone Co.; Sao Paulo Gas Co., Ltd.; and the City of Santos Improvement Co., Ltd. He was a native of Toronto.

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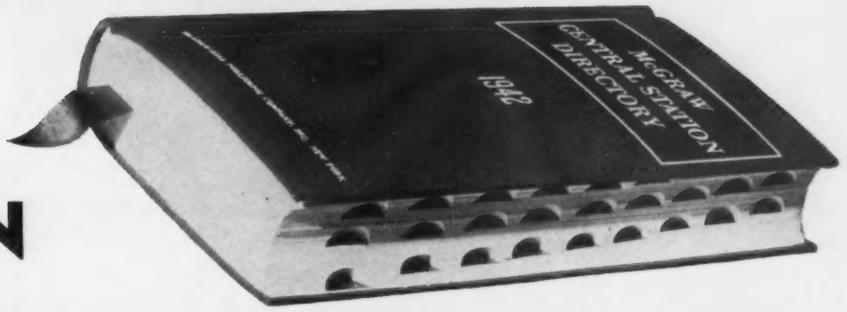

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For each operating company, the following information is presented:

Company total and Plant individual generating Capacity in kva. or kw.

Kind of Prime Mover and Capacity in hp.

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If the electric utility market is part of your picture, you can't afford to be without this new 1942 McGraw Central Station Directory. For there have been changes in the utility field during the past year—plenty!

Personnel has been changed . . . key men have been shifted . . . new power plants have been built to meet unprecedented load demands. The McGraw Central Station Directory supplies all the essential facts concerning these changes plus other complete, up-to-date information, in a form easy to use.

With manufacturers' sales forces decreased and new buyers and buying influences in the picture, this directory is an indispensable aid in providing vital information for new sales approaches.

How Hundreds Are Now Using This Directory

Manufacturers of Electrical Generating, Transmission and Distribution Equipment:

To secure names and addresses of utility officials, determination of important utility operating data and scope of utilities' operation.

Manufacturers of General Equipment and Supplies:

To secure names and addresses of utility plant officials, engineers, and purchasing agents, and determination of probable purchasing power for utility requirements.

Electrical Utilities:

To know organizational structure of other utilities, to keep posted on movements of utility officials and to size up discernible trends in expansion of operations.

Financial Houses, Consulting and Contracting Engineers, Commissions and Others:

To keep posted on changes in utility personnel, to know the organizational structure of every company and to secure a complete picture of each company's scope and operating data.

SEND TODAY FOR YOUR COPY OF THIS VALUABLE GUIDE TO UTILITY RELATIONS

McGRAW-HILL PUBLISHING COMPANY

CATALOG & DIRECTORY DIVISION • 330 WEST 42nd ST., NEW YORK, N. Y.

"Praise the Lord and *Pass the Ammunition*"

THIS Pearl Harborism,* uttered by a fervent Navy chaplain, will live in our school books long after today's headlines and swaying battle lines have passed into history.

It exactly expresses the unique combination of the spiritual and the practical which is inherent in our national character.

. . And America IS *passing the ammunition.* Starting with an atrophied military explosives industry in 1939, the Production for Defense program had raised the rate of "passing the ammunition" by 1400% at the time the chaplain spoke.

▶ Since then, according to an official statement of Donald Nelson:

"Explosives and ammunition are being made at many times the rate of last year as newly constructed plants come into operation. TNT is being made at a rate five times that before Pearl Harbor. Smokeless powder is being produced at a rate almost twice that before Pearl Harbor. One new plant is making more TNT today than the entire explosives industry produced in peacetime and there are several of this type of plant."

Incendiary bombs are vital ammunition in the kind of war we are in. America's chemical industry is far ahead of schedule in passing along that potent ammunition.

Magnesium is part ammunition, part construction material. You know it's now being taken from sea-water, but do you know that we are making at least 100 times as much magnesium now as we did in 1938?

100-octane gasoline isn't ammunition, but it's handy to have around in a war, because bombers using this product of American chemistry can carry an extra ton of what it takes to win.

Synthetic rubber is another necessity in passing the ammunition. The Chemical Industry faces the staggering job of producing more rubber than all the rubber trees in the world were able to pour into the American market prior to the war . . . 875,000 tons per year by 1944 is the goal. Those of us who have seen tank-factories and ship yards grow faster than the corn-crops they replaced believe the Chemical Engineers of America will do the job.

What is the secret of these amazing modern counterparts of the frontiersman's ability to turn from peace to war?

▶ One of the important answers is Chemical Engineering. We just naturally have more men and more machines that know how to make a molecule behave than any two nations on earth.

Starting after World War I, our chemical engineers used the experience gained in guncotton factories to develop the vast peacetime Chemical Industry which gave you rayon, lacquer, transparent wrapping paper, plastic telephones, knockless gasoline, shatterproof glass, synthetic vitamins, laboratory-fathered medicines, plastic tips for your shoe laces, nylon hosiery, and thousands of other comforts to help you live a peacetime Life of Riley.

This vast activity of making life more livable for peaceful Americans had created an enormous pool of management and production men in our chemical industries.

When war came, these men answered their country's call, by rearranging their peaceful atoms into bellicose molecules that would explode, fly, float, shoot or stop a bullet.

Today, fertilizer, salt, whiskey, rayon, even pine stumps are being turned into products of unrecognizable ferocity.

▶ When the war is over, it will be the imagination of the Men of Chemistry that will set our great new war-chemical plants upon a new era of peacetime fruitfulness. Even while the chemical engineer is breaking production records for war, he is planning for a peacetime production that will revert these molecules toward serving our daily lives. Chemical Warfare will become Chemical Welfare, through Imagination.

★ ★ ★

In recognition of the miracle of war production—accomplished through the cooperation of American management and labor with the W.P.B. . . . this 7th in a series of newspaper advertisements is published by the McGraw-Hill Network of Industrial Communication.

*Also title of Gene Lockhart's famous fighting song of World War II

McGRAW-HILL PUBLISHING COMPANY, Inc.

330 WEST 42ND STREET . . NEW YORK

This advertisement appears in a group of newspapers on Wednesday, September 9, 1942

. . . . . and pass the INFORMATION

WHEN an American gunner calls for ammunition, whether he wears a cross—like the chaplain in our newspaper advertisement—or a tattooed mermaid, he sets in motion the mightiest war-machine on earth . . . American Industry.

Knitting together all the industries of America, making it possible for them to turn *quickly* from peace to war, is the Industrial Press.

When the gunner yells for AMMUNITION, industry yells for INFORMATION. It is the job of the industrial magazines to supply it.

"What do we do when we can't get stainless steel for a Toluol recovery plant?"

"Which is the best section of the country for locating our new plant, considering power supply, bombing range and transportation?"

"How can we step-up the alcohol output of our stills, without using scarce metals?"

"What's the best method of training 18,000 green hands to get quick operating efficiency?"

These are typical of the questions that flow over the desks of our editors day after day.

They keep nearly 900 McGraw-Hill editors and engineer-correspondents busy, making field calls, finding the best answer to each problem and reporting the results to management and production men.

Industrial advertisers supplement this work by showing how their products meet specific needs.

This constant interchange of information is part of the strength and adaptability of American Industry.

It is so important that executives are surveying their organizations to make sure that the supply of Industrial Magazines is adequate.

If you would like suggestions as to how to conduct such a survey, write to The Reading Counselor, McGraw-Hill Publishing Company, Inc.

★ ★ ★

THE McGRAW-HILL NETWORK

23 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,000,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

THE McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL PUBLISHING COMPANY, Inc.
330 WEST 42nd STREET • NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL PUBLICATIONS

American Machinist
Aviation
Bus Transportation
Business Week
Chemical & Metallurgical Engineering
Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical West
Electrical World
Electronics
Engineering & Mining Journal
E. & M. J. Metal and Mineral Markets
Engineering News-Record
Factory Management & Maintenance
Food Industries
Mill Supplies
Power
Product Engineering
Textile World
Transit Journal
Wholesaler's Salesman

MANUFACTURING-MARKETS

Westinghouse Reports on Scrap Campaign

Westinghouse Electric & Manufacturing has salvaged an extra five million pounds of metal, rubber and other war-needed materials within the last three months at its East Pittsburgh Works alone, A. C. Streamer, vice-president, has announced.

"Nothing has been spared in our war on scrap," he declared. "We've scrapped many old electric motors which were beyond repair; one division turned in 300,000 pounds of old metal parts; by rummaging through office desks we collected hundreds of pounds of metal paper weights and tons of paper.

"An abandoned transformer tank at our high-voltage laboratory now is being dismantled to produce 10 tons of steel and five more of copper. Five miles of an old telephone line is being ripped up to get 8 tons of lead and another ton of copper."

•

Philco Gets Another "E"

In recognition of its outstanding war production record, the storage battery division of Philco Corp. has been awarded the joint Army-Navy "E," M. W. Heinritz, general manager of the Trenton plant, has announced. In addition to the storage battery division, Philco plants in Philadelphia and Sandusky have been awarded the Army-Navy "E" for excellence in war production.

•

NEMA Establishes Staff Service in Washington

For the benefit of members who wish to obtain staff assistance in Washington, D. C., the board of governors of the National Electrical Manufacturers Association has assigned Kenneth Andersen, executive assistant to the war projects committee, to spend two days there regularly each week. Effective September 16, his headquarters will be at the Carleton Hotel, Room 236, Telephone Metropolitan 2626, every Wednesday and Thursday until noon.

This service is offered on an experimental basis to assist those who wish to discuss priorities problems or to obtain suggestions regarding names and locations of persons to see in government agencies.

•

Ohmite Again Expands

Another large expansion in factory space and production facilities has been made by the Ohmite Manufacturing Co., Chicago. This is in addition to the big increase in plant size announced a short time ago.

Emerson Arranges $30,000,000 Credit

Emerson Electric Manufacturing Co. has arranged a $30,000,000 credit with a syndicate of banks to finance its war work. The company will pay 2½ percent interest on amounts actually borrowed and one-quarter of 1 percent on the unused portion of the credit, subject to the right to reduce the amount of the credit at any time. The credit expires July 1, 1944.

The war work which the company is scheduled to turn out in coming months is many times its largest normal volume in its 51-year history, W. S. Symington, president, said in a letter to preferred stockholders. The government is assisting in obtaining the necessary funds, Mr. Symington stated.

SUPERCHARGER PLANT DEDICATED—Allis-Chalmers Manufacturing Co. recently dedicated its new supercharger plant at Milwaukee weeks ahead of schedule. The new plant was started last October, the first machine was placed in operation in May and superchargers are now being shipped weeks ahead of schedule. Seventy-eight percent of the plant employees are women. Prior to the dedication, Brig.-Gen. K. B. Wolf, Wright Field, Dayton, Ohio, and Walter Geist, Allis-Chalmers president, paused to watch the inspection of an impeller wheel

HIGH conductivity

LOW voltage drop

FARGO

connectors

The "vise-like" grip of Fargo Connectors is the result of unique design and perfect machining of body and bolt.

The same careful machining results in high pressure contact between conductors and insures high conductivity with low voltage drop at the joint.

Another result of careful machining is the frequency with which Fargo Connectors may be reused over a long period of time.

Made by FARGO MFG. CO.
distributed by

LINE MATERIAL CO.
MILWAUKEE LM WISCONSIN

Manufacturers Issue Earnings Reports

Weston Electrical Instrument Corp. and subsidiary in a report for the six months ended June 30 showed a net profit of $358,218 after depreciation, amortization and provision of $2,653,000 for federal income and excess profits taxes. This net is equal to $2.23 a share on 160,583 shares (par $12.50) of common stock, and compares with a net profit reported for the similar 1941 period of $482,188, or $3.00 a share, when federal taxes on income were $930,000. The 1942 provision for federal taxes includes $548,000 for increase in taxes anticipated under legislation now pending, the report states.

Current assets as of June 30, 1942, including $1,465,813 cash and marketable securities, amounted to $7,161,655, and current liabilities were $5,404,403.

JOSLYN MANUFACTURING & SUPPLY—Six months to June 30, consolidated net profit, $423,258, equal to $2.50 a share on common stock, against $593,370, or $3.66 a common share, last year.

JOHNS-MANVILLE CORP. — Consolidated net income of Johns-Manville and subsidiaries for the second quarter of 1942 was $1,103,054 compared to $1,457,213 for the corresponding period last year, according to Lewis H. Brown, president. Earnings per share of common stock, after preferred dividends, were $1.24 for the quarter as against $1.62 per share last year. Net income, before taxes, was $9,776,979 in the first half of 1942 compared with $7,631,466 in 1941. Income and excess profits taxes were estimated at $7,977,591, compared with $4,612,664 last year. Net income for the first half of 1942 was $1,799,389. Sales for the first six months amounted to $48,754,848.

•

Matthews Clears Arrears

Announcement has been made by the W. N. Matthews Corp., St. Louis, Mo., of the payment of a $12 ¼ dividend per share on the 7 percent preferred stock, which clears up arrears on this issue.

•

Pledged Bonds Exceeded

General Electric employees, who pledged themselves to buy $33,949,193 worth of war savings bonds a year have already exceeded that mark. Payroll deductions which have been applied according to the "10 percent" plan now amount to a $35,000,000 annual rate for bonds having a maturity value of $47,000,000. At present fifty employees of the company's bond office at Schenectady are devoting their full time to the maintenance of accounts and the issuing of bonds. This figure does not include the employees of payroll departments where the deductions for bonds are calculated and recorded.

What have organ pipes to do with—

WAR?

Just this . . . !

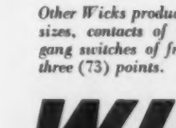
THE WICKS Company, building musical instruments for almost two score years, has now changed over to war production. WICKS precision built relays, switches, magnets, contacts, etc., are now available to war industries.

Sturdy built and well designed, WICKS units can provide a dependable, extremely efficient integral part of America's *fighting power.*

WICKS magnets operate on from ten (10) to fifteen (15) volts D.C. and consume a minimum of current. Windings can be changed to accomodate higher or lower voltages. List your requirements when writing. ★ ★ ★ ★

Magnets of the rotary type as built by Wicks are very efficient. They can be used to advantage for actuating mechanism, giving dependable service at low cost. ★ ★ ★

Small relay of one to four contacts, or make and break arrangement. Low current consumption on D. C.



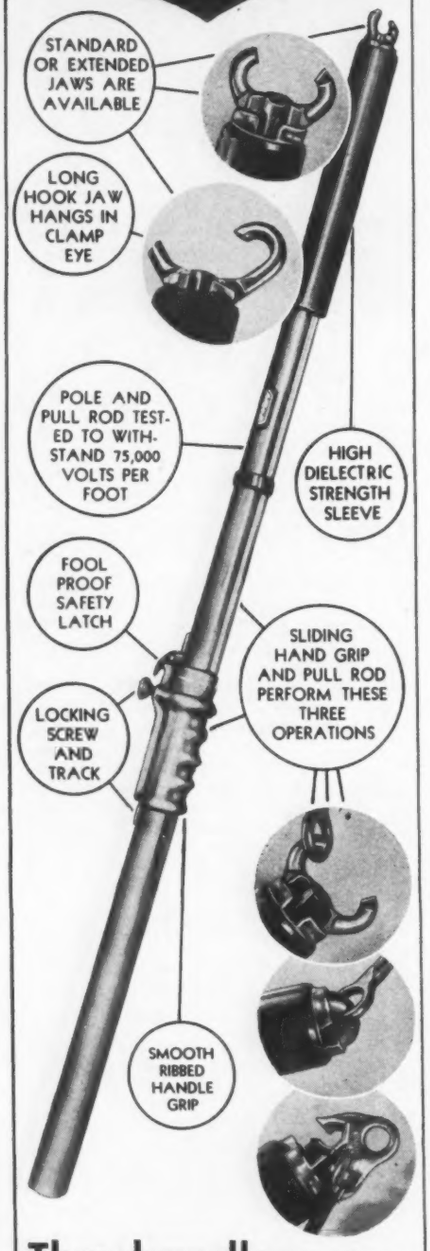
Relays of from eight to eighteen points, self-cleaning contacts, magnet, operates on low or high D. C. voltage, low amperage. Sturdy construction.

Other Wicks products include magnets of many sizes, contacts of various types, grounds and gang switches of from twenty (20) to seventy-three (73) points.

WICKS

WICKS WAR UNITS
DIV'N—WICKS ORGAN COMPANY
HIGHLAND — ILLINOIS

TIPS GRIP-ALL CLAMP STICKS are "indispensable" operating and line maintenance tools


STANDARD OR EXTENDED JAWS ARE AVAILABLE
LONG HOOK JAW HANGS IN CLAMP EYE
POLE AND PULL ROD TESTED TO WITHSTAND 75,000 VOLTS PER FOOT
HIGH DIELECTRIC STRENGTH SLEEVE
FOOL PROOF SAFETY LATCH
SLIDING HAND GRIP AND PULL ROD PERFORM THESE THREE OPERATIONS
LOCKING SCREW AND TRACK
SMOOTH RIBBED HANDLE GRIP

They handle many different jobs...

To make tap clamp manipulation easy and to perform an endless variety of "hot" jobs, every operating crew should be equipped with one or more Grip-All Clamp Sticks. They are indispensable to men who have used them because their operation is so simple, and they can handle so many different jobs with complete safety to the operator.

All Grip-All Sticks are tested to withstand 75,000 volts per foot.

They are available with either type jaws.

A·B·CHANCE CO·
CENTRALIA, MISSOURI.

TIPS TOOLS

Field Reports on Business

Government schedules are keeping electrical manufacturers busy on a wide variety of electrical equipment. Demand is urgent for electric cable and insulated wire. Lighting equipment is active, the demand being created by the widely scattered camps, fields and hospitals. Consumers goods stocks are declining rapidly.

NEW ENGLAND

Tobe Deutschmann Corp., Canton, Mass., is producing $5,000,000 worth of static eliminating filters for the armed forces this year against sales of $100,000 in 1940. Hudson (Mass.) Light & Power Department is seeking a $50,000 appropriation to complete plant expansion now in progress and involving a 2,000-kva. Busch-Selzer Diesel unit. Electrical manufacturers in this district are busy on government schedules for an immense variety of electrical equipment. The demand for electric cable, insulated wire, submarine cable, and magnet wire is urgent. Lots of wire and cable ranging from 5,000 ft. to over 75,000 ft. have received attention recently. Radio vacuum tubes, antenna wire, oscillators, analyzers, and other communication accessories of a highly specialized order are active.

Bids were placed here recently for over 150,000 lamp cords; electric tallow pots, capacitors, rheostats, and resistors in small lots are among the smaller electric equipment listed in late schedules. A severe shortage of electric welding wire continues to hamper some production; supplies for rehabilitating stand-by electrical machinery are running short according to some sources.

Pascone Bros. Co., Bridgeport, Conn., have been awarded a contract for the construction of water, electric and sewage systems in a Connecticut industrial area, at a cost estimated under $50,000. Brady Electric Co., Fall River, Mass., has been awarded a similar contract which includes the construction of an electrical distribution system in the Rhode Island industrial area.

Approaches to Army cantonments, extension of airport runways, and the development of areas reserved for Army use will offer sales of some lighting supplies. Simplex Wire & Cable Co., Cambridge, Mass., has added a new testing tank to its electrical engineering laboratory.

Negotiated contracts for machine tools, compressors, small tools, and communication apparatus in encouraging amounts have been completed recently.

PACIFIC COAST

New regulations permitting thinwall instead of thickwall steel conduit in sizes through two-inch and fibre conduit for larger sizes will ease the shortage of roughing-in materials for big camps, yards, and bases for at least a few weeks, until orders for the new materials accumulate and have to be replaced by something else. Wholesalers report fairly steady volume of business, though because of the mounting volume of 1941 business at this time, the rate of increase month by month over 1941 is steadily decreasing.

Contractors are figuring on electrical distribution systems for many widely scattered camps, fields and hospitals, the exact installation figures not being made public, but probably averaging $50,000 each or $25,000 for lighting the average smaller field.

Industrial developments cover start of construction for Columbia Steel's 30,000-ton annual capacity addition to its Pittsburg plant, costing $6,000,000 and including a six-ton electrical furnace; and basic magnesium's plant at Las Vegas, Nev., to be the world's largest of its kind. Machinery orders, which have slumped considerably since midyear, include three 250 kva. transformers for Los Angeles; $30,000 motors and controls for pneumatic tools; a $25,000 frequency changer set; $10,000 radio tubes for an Army station and $17,500 motor generator sets for Mare Island.

NEW YORK

From a decline of 13 percent registered in the week ended August 29, department store sales, in the week ended September 5 showed a gain of 25 percent as compared with the corresponding period last year, according to figures released by the Federal Reserve Board. The increase in part was attributed to the fact that there were six shopping days in the week this year, while in the corresponding week last year there were only five days owing to the earlier date of the Labor day holiday. For the latest four-week period the increase is 1 percent.

Engineering construction for the short week of the holiday totaled $97,311,000, compared with $261,671,000 reported for the week previous and $139,478,000 for the full week in 1941, according to *Engineering News-Record*. August engineering construction reached $813,077,000, an average of $203,269,000 for each of the four weeks. With the latest week's figures, 1942 volume reaches $7,278,879,000, an increase of 60 percent over the total reported for the 37-week period last year and 24 percent over the volume for the entire year of 1941.

CHICAGO

Reports from various electrical companies in this area show mixed trends in business. Of thirty manufacturers reporting August sales to the Electric Association, 18 show an increase over July, while 16 had a gain over August, 1941. For the first eight months, 18 had increases, two were unchanged and 10 show a decrease in sales.

With further restrictions on material uses going into effect, near capacity production and delays in securing materials and parts it is becoming increasingly difficult to record any sales gains. Wholesalers and dealers stocks on consumers goods are declining rapidly. There is still quite a bit of merchandise available but the selection is narrow and rapidly getting worse.

The many construction jobs on new war plants and expansion of existing factories in progress are keeping the contractors working full time. However, much of this work is moving rapidly toward completion and within six months to a year, the situation will be entirely changed. A ban was placed on all new housing in this city last week, which will still further restrict the smaller contractors.

New industrial plants and additions authorized here during the past month have amounted to $49,479,000. So far this year, the Chicago industrial field has been expanded by $530,670,000 in new building, as compared with $155,602,000 during the first eight months of 1941.

Sales Opportunities

NEW YORK—Central New York Power Corp., Syracuse, has contracted with local office of the U. S. District Engineer for extensions in transmission and distributing lines, including power substation and service facilities for power supply for a government development in that area.

NEBRASKA—Central Nebraska Public Power & Irrigation District, Hastings, plans extensions in transmission line for power supply for naval station. Permission has been secured and work will be placed under way soon.

ILLINOIS—War Department, Washington, D. C., has authorized new military cantonment, comprising large group of one and multi-story buildings, including shops and other industrial structures, with complete electrical equipment and facilities for industrial and residential service. A power substation and boiler house are planned, with electrical distribution system. Entire project will cost in excess of $5,000,000 and will be supervised by U. S. District Engineer Office, Chicago.

ALABAMA—U. S. District Engineer Office, Nashville, Tenn., plans four new auxiliary flying field bases, with installation of complete lighting facilities, including boundary lights, marker lights, underground parkway cable lines, transformer and control stations, etc. Bids are scheduled to be asked soon.

PENNSYLVANIA—Keystone Public Service Co., Oil City, has completed plans for proposed expansion and improvements in steam power plant, and will carry out work with company forces. No estimate of cost announced.

UTAH—Utah Copper Co., Kearns Building, Salt Lake City, has approved plans for new central power plant at mining properties, with installation to include turbine-generator units, boilers and auxiliary equipment. Cost reported in excess of $300,000. Work will be placed under way at once.

TEXAS—Bayou Pipe Line System, Inc., recently organized, care of Shell Pipe Line Corp., Shell Building, Houston, plans series of electric-operated pumping stations for booster service in connection with new welded steel pipe line, total distance over 275 miles. Central station service will be used for power supply, with transformer stations and switching facilities at respective pumping plants. New line will be used for oil transmission and is estimated to cost about $7,000,000. Financing in that amount will be furnished by companies identified with new organization, including Shell company, noted, Humble Pipe Line Co., Pure Oil Transportation Co., Texas Pipe Line Co., Pan-American Pipe Line Co., and Crown Central Pipe Line & Transportation Corp., all of Houston. Shell company will be in charge of project.

NEW YORK—Long Island Lighting Co., Mineola, L. I., has contracted with War Department, Washington, D. C., for extensions in distributing lines and installation of lighting systems for government developments. Work will be carried out soon.

SOUTH DAKOTA—War Department, Washington, D. C., has approved plans for new air force base, consisting of a series of buildings, including hangars, shop and other industrial structures. Complete electrical equipment and facilities will be installed, with electrical distribution system, airfield lighting system, etc. A power substation and boiler house will be installed. Entire development will cost over $2,000,000, and will be supervised by U. S. District Engineer Office, Omaha, Neb.

ARIZONA—Aluminum Co. of America, Inc., Gulf Building, Pittsburgh, Pa., has plans maturing for new aluminum extrusion plant, to include a main one and multi-story building of 2,000,000 sq. ft. floor area, and group of other structures for miscellaneous service. Complete electrical equipment and facilities will be installed, with several transformer stations, underground conduit system and night-lighting installation. A power plant will be built. Entire project will cost approximately $30,000,000, with financing through Defense Plant Corp. Output will be used by government. Work will begin at early date. Wyatt C. Headrick, First National Bank Building, Dallas, Texas, is architect.

INDIANA—New addition to Dresser steam-electric generating station of Public Service Co. of Indiana, Indianapolis, recently noted in these columns, will provide for installation of new 50,000-kw. turbine-generator unit and accessories, to be known as Unit No. 5; also boiler plant equipment auxiliary apparatus. Switchyard will be enlarged, and extensions made in transmission lines. Entire project is reported to cost in excess of $4,500,000, and is scheduled for completion in 1943. Sargent & Lundy, Inc., 140 South Dearborn Street, Chicago, Ill., is consulting engineer.

DISTRICT OF COLUMBIA—Federal Works Agency, Public Buildings Administration, Washington, plans expansion and improvements in power plant at local Gallinger Hospital, with installation of equipment for increased capacity. Fund of $608,500 has been authorized for this and new addition to main hospital unit.

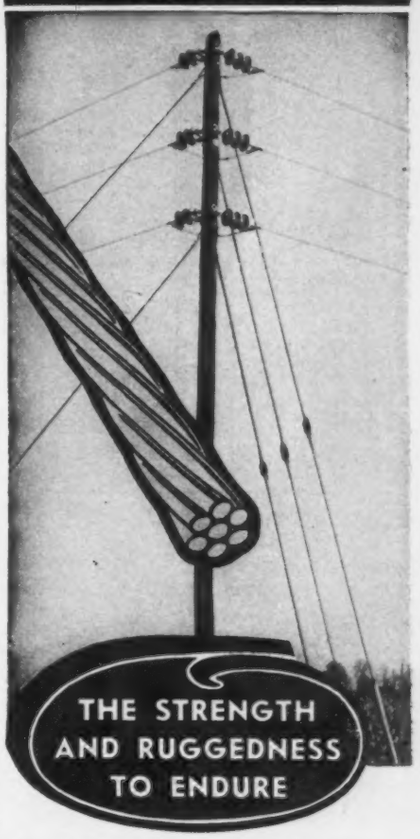
TEXAS—War Department, Washington, D. C., has authorized new air force base, consisting of a number of one and multi-story buildings, with hangars, shops and other industrial structures. Complete electrical equipment will be installed for industrial and residential service, with power substation and electrical distribution system. Entire development will cost over $3,000,000 and will be supervised by U. S. District Engineer Office, Albuquerque, N. M. Work will begin soon.

PENNSYLVANIA—Fraser-Brace Engineering Co., Inc., 10 East Fortieth Street, New York, N. Y., has contracted with War Department, Washington, D. C., for expansion in plant now in course of construction. New work will include a large group of one-story buildings, with complete electrical equipment and facilities. Cost estimated over $5,000,000, in addition to appropriation of about $31,000,000, originally allotted for project. Financing will be provided by Defense Plant Corp., and work supervised by U. S. District Engineer Office, Pittsburgh.

NEW YORK—Day & Zimmermann, Inc., Packard Building, Philadelphia, Pa., engineer and contractor, has secured contract from War Department, Washington, D. C., for installation of counterpoise system for transmission lines, including design.

LOUISIANA—Municipal Electric Light & Water Works, Alexandria, plans extensions in transmission lines, totaling about five miles.

Crapo
GALVANIZED STEEL
STRAND



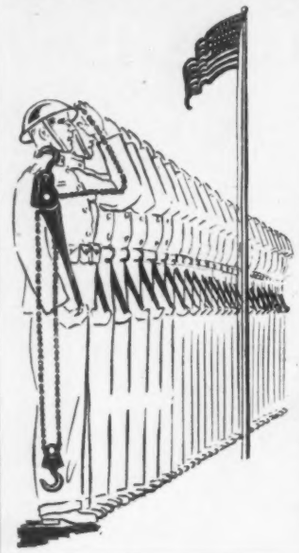
STRENGTH to support the pole structure under maximum ice and wind loading ... **RUGGEDNESS** to withstand the punishment incurred in construction and service .... **DURABILITY** that outlasts the normal life of the line .... are combined---with important **ECONOMY**---in *Crapo* Galvanized Steel Strand.

Each size and grade develops the full tensile strength of the steel in cross section. The heavy, ductile, tightly-bonded zinc coating---applied by the famous *Crapo* Galvanizing Process---provides lasting protection against corrosion.

There is a size and grade of *Crapo* Galvanized Steel Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

COFFING Safety Pull Ratchet Lever HOISTS



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Conserve Your Hoists and HELP WIN THE WAR

See Your Distributor or Write for Catalog No. EG-6

COFFING HOIST COMPANY

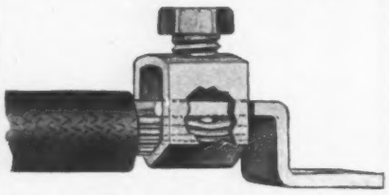
Ratchet Lever, Spur Geared and Electric Hoists

800 WALTER ST., DANVILLE, ILLINOIS

ILSCO

SOLDERLESS CONNECTORS

"X-Ray" View Shows UNYIELDING GRIP PRODUCED BY SERRATIONS



Wires are nested and wedged in and holding power is at maximum by the serrations both in the collar and tongue. Maximum contact is established and even pressure is distributed over the curve of the conductors held.

No special tools required. Cut wiring costs and time . . . but not the wires.

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Please rush us sample and illustrated 32-page catalog.

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ILSCO MARIEMONT, OHIO

COPPER TUBE & PRODUCTS, INC.

LETTERS TO THE EDITOR

Series Capacitors for Transmission

To the Editor of ELECTRICAL WORLD:

In the July 11 issue of the ELECTRICAL WORLD, page 63, a brief report is given of the discussion at the A.I.E.E. summer convention on the paper "Series Capacitors for Transmission Circuits," which was presented by E. C. Starr and R. D. Evans. In order for the readers of the ELECTRICAL WORLD to interpret properly the reported critical views of J. W. Butler, we would like to make the following points:

The use of series capacitors to compensate for the reactance of transmission circuits has been recognized as a technical possibility for 50 years. However, when transient stability of transmission systems was first given active consideration, about 20 years ago, series capacitors were considered to be ineffective from the stability standpoint if provided with protective gaps and uneconomical if they were designed to withstand voltages resulting from fault currents. This view of series capacitors was held for a number of years, as shown by the discussion in the report of the A.I.E.E. subcommittee on interconnection and stability factors, A.I.E.E. *Transactions*, page 264, 1937, the pertinent excerpt from which is as follows:

". . . To protect the capacitor against puncture the usual practice (in using series capacitors) is to use a normal-voltage capacitor with means to short circuit it during excess current conditions. The series capacitor as proposed is thus rendered ineffective at the time when it is most needed. The alternative is to use capacitors capable of withstanding the high voltages arising under fault conditions. In no major project in America has the series capacitor received serious consideration."

In the paper we advocated series capacitors for transmission circuits and described a new scheme of operation and protection. This scheme is based on using series capacitors of the protected type in combination with high-speed line sectionalizing circuit breakers and relays. In this scheme the series capacitors are (1) short circuited upon the occurrence of the fault which would produce excessive voltage and (2) quickly restored to the circuit after the fault is cleared, the combination functioning in a sufficiently short time to make a substantial improvement in transient stability over the value obtainable without the series capacitor. While the essential elements of the scheme are simple and easily understood, it involves a conception that is expected to make feasible the application of series capacitors for major transmission circuits. We do not find the essential combination of elements for a practical series-capacitor installation to improve transient stability in the descripton given of the installations to which Mr. Butler referred.

Unfortunate Misapplications

It was pointed out in our closure that despite the inferred complete mastery of the problem prior to 1935, certain misapplications of series capacitors subsequent to this date have placed the device in an unfavorable light among some engineers. Previous papers have discussed voltage-regulation and steady-state stability problems. The present paper is concerned with the much different problems of economics and transient stability in major circuits.

Our paper presented a radically different view of series capacitors for transmission circuits from that given in the A.I.E.E. subcommittee report previously mentioned. Our view, that series capacitors provide an economical and practical scheme, was concurred with in the discussions presented on our paper by S. B. Crary and A. C. Monteith. We believe that the change in view concerning the use of capacitors on transmission circuits has been largely the result of the work which was presented in the paper and the new scheme of operation and protection which we described.

When series capacitors were first installed, they were widely heralded as providing a new scheme for improving power transmission. Since then series capacitors have achieved some extent of use in distribution circuits. However, in the power transmission field the results during these 15 years have been disappointing and we understand that the original installation itself has been removed from service. The question naturally arises as to why the series capacitor development has not lived up to its original expectations. The answer, we think, lies in the fact that the usefulness of series capacitors on transmission circuits is to improve economy and transient stability. These phases of the subject were neglected and it remained for the authors of the present paper to investigate the problem and to provide the necessary functional schemes to make it practical.

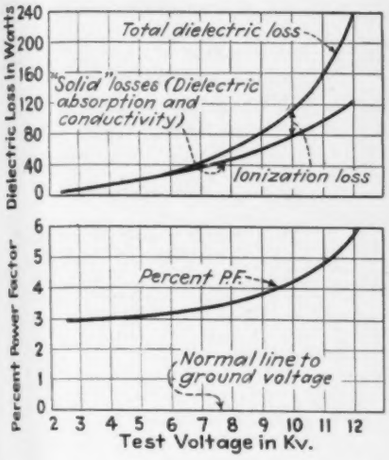
E. C. STARR, Professor of Elec. Eng., Oregon State College, Corvallis.

R. D. EVANS, Consulting Transmission Engr., Westinghouse Elec. & Mfg. Co., East Pittsburgh.

Correction for Generator Insulation

To the Editor of ELECTRICAL WORLD:

There is a small error in Fig. 3 (page 55) of the article "A.C. Generator Insulation Testing Progresses" which appears in the August 22, 1942, issue of the ELECTRICAL WORLD.



The note on the bottom curve of Fig. 3 should read "Normal line to ground voltage" and the arrow should point to 7.6 kv. instead of 5.6 kv. A revised reproduction of Fig. 3 is shown herewith.

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BOOKS RECEIVED

Microwave Transmission—By J. C. Slater. McGraw-Hill Book Co., New York. 309 pages, illustrated. Price $3.50.

An M.I.T. addition to the International Series in Physics, treating coaxial propagation intervening between radiation and absorption of waves between 1 centimeter and 1 meter; based on Maxwell's equations and geared to the mathematical equipment of average graduate electrical engineers with communication leanings.

Principles of Radio. By Keith Henney. John Wiley & Sons, Inc., New York. 549 pages, illustrated. Price $3.50.

Power engineers, whether intent upon radio or not, can here obtain an unusually lucid, simple and relatively nonmathematical introduction to electronic engineering because the book is phrased for self-teaching and geared not to college but to trade school and camp capacities to absorb. This is a fourth revised edition.

Handbook of Ship Calculations, Construction and Operation. By Charles H. Hughes. Published by McGraw-Hill Book Company, New York, N. Y. 558 pages, illustrated. Price $5.

Sections on welding, propulsion, accessory facilities and electrical distribution requirements aboardship will help industrial electrical engineers at shipyards and in the engine room understand why turbines, panels, wiring and control have to differ from land practices.

Ultra-High-Frequency Techniques. By Professors J. G. Brainerd, Glenn Koehler, H. J. Reich and L. F. Woodruff. Published by D. Van Nostrand Company, 250 Fourth Ave., New York, N. Y. 534 pages, illustrated. Price, $4.50.

Reproduced by offset to be quickly available, this book comprises the technical bases for the ultra-high-frequency techniques which are proving of such high military value that electrical engineers are being circularized to disclose more talent for induction into this service. The subject matter is that which emerged from the forty-institution conference last fall at the Massachusetts Institute of Technology; none of the military adaptations are disclosed. It reassembles the pertinent mathematical knowledge about conventional radio, television, facsimile, etc., for extension of tube, circuit and propagation technique into the higher frequencies. Graduates of electrical courses, particularly those who had exposure to electronics, will find nothing mathematically insuperable nor should those in the power field who have acquired familiarity with the terminology and tooling of carrier and mobile communications. The book is a "must" for any engineer (or his son) who wants to render immediate service to his country and has a competent electronic background.

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